Zeitschrift: Eclogae Geologicae Helvetiae

Herausgeber: Schweizerische Geologische Gesellschaft

Band: 79 (1986)

Heft: 3

Artikel: The foraminifera in the lower Createaceous of Trinidad, W.I. Part 5, Maridale formation, upper Part : Hedbergella rohri zone

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DOI: https://doi.org/10.5169/seals-165857

Eclogae geol. Helv.	Vol. 79	Nr. 3	Pages 945–999	Basel, November 1986

The Foraminifera in the Lower Cretaceous of Trinidad, W. I. Part 5: Maridale Formation, upper Part; *Hedbergella rohri* Zone[1])

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ABSTRACT

Part 5 completes the series "The Foraminifera in the Lower Cretaceous of Trinidad, W. I." (BARTENSTEIN, BETTENSTAEDT & BOLLI 1957, 1966 and BARTENSTEIN & BOLLI 1973, 1977). The age of the investigated fauna in these five parts ranges from Early Barremian to Early Albian, which covers a time span of some 12 million years. In Part 5 are described and figured 136 species or forms in open nomenclature. Of these are new: *Dentalina bonaccordensis*, *Lenticulina (L.) antillica* and *Lenticulina caribica*. Based on planktic and benthic index forms the fauna is assigned a Late Aptian to earliest Albian age. It originates from a boulder in the Late Eocene Bon Accord boulder bed at Pointe-à-Pierre.

Attached to Part 5 is an index covering all 78 genera, 185 species and subspecies, including 13 new species and subspecies, and 52 forms with open nomenclature dealt with in Parts 1–5.

CONTENTS

Introduction

The Lower Cretaceous foraminifera known from Trinidad range in age from Early Barremian to Early Albian and occur in the Toco, Cuche and Maridale formations. The benthic and some of the planktic faunas have already been published in four parts:

[1]) Part 1: Cuche- und Toco-Formation. Eclogae geol. Helv. *50*/1, 5–67 (1957). – Part 2: Maridale-Formation (Typlokalität). Eclogae geol. Helv. *59*/1, 129–177 (1966). – Part 3: Maridale-Formation (Co-Typlokalität). Eclogae geol. Helv. *66*/2, 389–418 (1973). – Part 4: Cuche-Formation, upper Part; *Leupoldina protuberans* Zone. Eclogae geol. Helv. *70*/2, 543–573 (1977).

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BARTENSTEIN, BETTENSTAEDT & BOLLI (1957, 1966); BARTENSTEIN & BOLLI (1973, 1977). Separate papers on planktic foraminifera were published by BOLLI (1957a, 1959). The planktic foraminifera of Late Albian to Late Maastrichtian age (Gautier, Naparima Hill and Guayaguayare formations) were published by BOLLI (1951, 1957b, 1959) and by BRÖNNIMANN (1952). The benthic foraminifera of these younger formations are now being studied and prepared for publication by J. P. Beckmann.

As has been made clear in earlier publications dealing with foraminifera from the Cretaceous of Trinidad, no continuous sections of significant stratigraphic extent are known. This is particularly true for the Lower Cretaceous. As a consequence, each of the faunas dealt with in Parts 1–4 and also in the present Part 5 originates from isolated outcrops.

A short discussion of the lithology and stratigraphic position of the Maridale Formation, its relation to the Cuche Formation and a historic review were given in Part 2 (p. 130–135). In the following notes the lithologic characters of the Maridale Formation, its known occurrence as slip masses or boulders, its relation to the Cuche Formation as seen today and the distinction and characterisation of its two foraminiferal zones are further elaborated.

Lithologically the Maridale Formation consists of dark grey to blue-grey marls weathering to a yellowish-brown colour. These marls are only known as slip masses or blocks in younger formations. This is shown in Part 1 (Fig. 2, p. 10) on a section through the northern Pointe-à-Pierre area. Here blocks or slipmasses are embedded in the Oligo-Miocene Nariva Formation. The position of the *Hedbergella rohri* Zone of the Maridale Formation dealt with here is shown on that Figure 2 as a slip mass of Maridale Marl (wavy signature), some 100 m southeast of the Bon Accord Marl type locality.

The sample from which the fauna is described here comes from a boulder which was exposed in a trench dug at Pointe-à-Pierre about 100 m east of the Bon Accord Marl type locality. This artificial outcrop is no longer accessible.

The marls in the lower part of the *Planomalina maridalensis* Zone of the Maridale Formation are rich in benthic and planktic foraminifera and radiolaria. Other microfossil remains like ostracodes are scarce. The *Hedbergella rohri* Zone in contrast is characterized by predominantly benthic foraminifera, comparatively few planktic forms and the absence of radiolaria. Planktic index species restricted to one zone are the zonal marker, *Planomalina saundersi* and *Biglobigerinella barri* in the *Planomalina maridalensis* Zone and the zonal marker and *Planomalina cheniourensis* in the younger *Hedbergella rohri* Zone. Based on the strongly different composition of the planktic association of the two neighbouring zones it can be concluded that an appreciable stratigraphic interval divides the samples from which the two faunas originate.

The fauna of the *Hedbergella rohri* Zone (formerly named *Praeglobotruncana rohri* Zone) is the youngest studied in this project. The zone was originally proposed by BOLLI (1959) and at the time considered to be of Middle–Late Albian age. Subsequent investigations on planktic foraminifera led to the conclusion that the *Hedbergella rohri* Zone fauna is rather of Late Aptian to earliest Albian age or, in zonal terms of CARON (1985), approximately equivalent to the *Ticinella bejaouensis* Zone which straddles the Aptian/Albian boundary.

In contrast to Part 1 where planktic foraminifera were not included and Parts 2–4 where only the more significant species were dealt with, all planktic taxa found in the

Hedbergella rohri Zone material are treated in the present final Part. The reason for this is that since publication of Parts 1–4 (1957, 1966, 1973, 1977) and the papers on planktic foraminifera by BOLLI (1957a, 1959) new evidence on Early Cretaceous planktic foraminifera and their stratigraphic significance has become available pointing to a slightly older age assignment of the *Hedbergella rohri* Zone (Late Aptian–earliest Albian against Middle–Late Albian).

Systematic descriptions

AGGLUTINATED FORAMINIFERA

Superfamily Ammodiscacea

Ammodiscus tenuissimus (GUEMBEL 1862)

Pl. 1, Fig. 1–3

1975 *Ammodiscus tenuissimus* (GUEMBEL) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 21; Pl. 1, Fig. 1–4, 7–13, 25.

Occurrence. – Worldwide from Middle Jurassic to Lower Cretaceous.

Glomospira charoides (JONES & PARKER 1860)

Pl. 1, Fig. 4

1967 *Glomospira charoides* (JONES & PARKER) – MICHAEL, Palaeontographica, Suppl. *12*, 23; Pl. 1, Fig. 8.

Remarks. – The few tests present may also be close to *Glomospira gordialis*, a species of considerable variability.

Glomospira gordialis (JONES & PARKER 1860)

Pl. 1, Fig. 5–6

1973 *Glomospira gordialis* (JONES & PARKER) – BARTENSTEIN & BOLLI, Trinidad *3*, 395; Pl. 2, Fig. 14–17.

Occurrence. – Worldwide from Jurassic to Recent. For further information see remarks in Trinidad *3*, 395 (1973).

Glomospirella gaultina (BERTHELIN 1880)

Pl. 1, Fig. 7–8

1973 *Ammodiscus gaultinus* BERTHELIN – BARTENSTEIN & BOLLI, Trinidad *3*, 394; Pl. 2, Fig. 1–13.

Occurrence. – Worldwide in the Cretaceous, common.

Hippocrepina depressa VASICEK 1947

Pl. 1, Fig. 9–10

1980 *Hippocrepina depressa* VASICEK – SLITER, Init. Rep. Deep Sea Drill. Proj. *50*, Pl. 1, Fig. 2–3.
1984 *Hippocrepina depressa* VASICEK – GEROCH & NOWAK, Benthos *83*, 228; Pl. 1, Fig. 7; Pl. 5, Fig. 4–5.

Occurrence. – Worldwide from Lower Cretaceous to Recent; according to SLITER (1980) belonging to a deep-sea foraminiferal assemblage of Valanginian to Berriasian(?) age with water depths of 2000 m and more; according to GEROCH & NOWAK (1984) from Upper Hauterivian to Eocene in the Polish Flysch sequence.

Hormosina ovulum (GRZYBOWSKI 1896)

Pl. 1, Fig. 11–13

1984 *Hormosina ovulum ovulum* (GRZYBOWSKI) – GEROCH & NOWAK, Benthos *83*, 228; Pl. 1, Fig. 14, 19–21; Pl. 5, Fig. 14–16, 22–23.

Occurrence. – Worldwide throughout the Cretaceous and in the Tertiary; according to GEROCH & NOWAK (1984) from Hauterivian to Paleocene in the Polish Flysch sequence; the subspecies *Hormosina ovulum crassa* GEROCH 1966 from Barremian to Lower Cenomanian.

Hyperammina gaultina DAM 1950

Pl. 1, Fig. 14–17

1973 *Hyperammina gaultina* DAM – BARTENSTEIN & BOLLI, Trinidad *3*, 392; Pl. 1, Fig. 3–21.

Occurrence. – Worldwide throughout the Lower Cretaceous, common in the Aptian and Albian with finely or coarsely arenaceous tests. According to SLITER (1980: 357) *Hyperammina* belongs in Albian–Cenomanian samples to the same deep-sea foraminiferal assemblage as *Hippocrepina, Glomospira, Glomospirella, Ammodiscus* and other arenaceous genera indicating Cretaceous abyssal water depths of 3000 to 4000 meters.

Kalamopsis grzybowskii (DYLAZANKA 1923)

Pl. 1, Fig. 18–19

1984 *Kalamopsis grzybowskii* (DYLAZANKA) – GEROCH & NOWAK, Benthos *83*, 228; Pl. 1, Fig. 2–3; Pl. 5, Fig. 2–3.

Occurrence. – Worldwide in Upper Jurassic(?), Lower Cretaceous to Recent; according to GEROCH & NOWAK (1984) from Aptian to Eocene in the Polish Flysch sequence.

Remarks. – The Lower Cretaceous specimens of the genera *Hormosina* and *Kalamopsis* may be closely related, in particular if we compare the mostly fragmental material of tests in Lower Cretaceous publications cited by GEROCH (1966), GRÜN (1969) and GEROCH & NOWAK (1984).

Similar difficulties exist in the distinction of fragmental tests of the group which includes *Rhizammina, Bathysiphon* (in parts), *Hyperammina, Kalamopsis* and *Hippocrepina* in the Lower Cretaceous. Nearly all tests assigned to these genera can have a chitinous wall with some finely agglutinated material and a simple opening or a distal tube serving as aperture.

Psammosphaera sp.?

Pl. 1, Fig. 20–23

Remarks. – The very rare specimens are single chambered without a definite aperture; in Trinidad the tests are flattened and occasionally have a central depression. The wall is finely agglutinated with much cement, surface smoothly finished, colour light grey. Broken tests show a small internal tube within the relatively thick exterior walls (Fig. 21). Figure 23 shows a colonial growth with loosely united chambers. See the remarks by CUSHMAN (1950: 74, Saccamminidae).

Reophax guttifer H. B. BRADY 1884

Pl. 1, Fig. 24

1973 *Reophax guttifer* H. B. BRADY – BARTENSTEIN & BOLLI, Trinidad *3*, 393; Pl. 1, Fig. 27–33.

Occurrence. – Worldwide from Jurassic to Recent. For further information see remarks in Trinidad *2*, 137 (1966).

Reophax minutus TAPPAN 1940

Pl. 1, Fig. 25

1984 *Reophax minutus* TAPPAN – GEROCH & NOWAK, Benthos *83*, 226; Pl. 1, Fig. 9; Pl. 5, Fig. 17–19.

Occurrence. – Washita Group in Texas, corresponding to lower Upper Albian in Europe; worldwide from Middle Barremian to basal Cenomanian according to BARTENSTEIN (1979); Upper Barremian to Turonian in the Polish Flysch sequence according to GEROCH & NOWAK (1984).

Reophax pilulifer H. B. BRADY 1884

Pl. 1, Fig. 26–27

1973 *Reophax pilulifer* H. B. BRADY – BARTENSTEIN & BOLLI, Trinidad *3*, 392; Pl. 1, Fig. 34–41.

Occurrence. – Worldwide from Jurassic to Recent. For further information see remarks in Trinidad *2*, 136–137 (1966).

Superfamily Lituolidea

Ammobaculites euides LOEBLICH & TAPPAN 1949

Pl. 1, Fig. 28–30

1973 *Ammobaculites euides* LOEBLICH & TAPPAN – BARTENSTEIN & BOLLI, Trinidad *3*, 394; Pl. 2, Fig. 18–21.

Occurrence. – Fredericksburg Group in Texas corresponding to the Middle Albian in Europe.

Ammobaculites reophacoides BARTENSTEIN 1952

Pl. 1, Fig. 31–32

1977 *Ammobaculites reophacoides* BARTENSTEIN – BARTENSTEIN & BOLLI, Trinidad *4*, 546; Pl. 1, Fig. 10–13.

Occurrence. – An index form of the boreal and tethyan realms, from Lower Barremian to Middle Albian.

Remarks. – Trinidad specimens mostly have irregularly compressed tests with tile-like overlapping chambers.

Ammobaculites subcretaceus CUSHMAN & ALEXANDER 1930

Pl. 1, Fig. 33–34

1973 *Ammobaculites subcretaceus* CUSHMAN & ALEXANDER – BARTENSTEIN & BOLLI, Trinidad *3,* 394; Pl. 2, Fig. 63–64.

Occurrence. – Worldwide in the Jurassic and Lower Cretaceous, Upper Cretaceous(?).

Bigenerina clavellata LOEBLICH & TAPPAN 1946

Pl. 1, Fig. 35–36

1973 *Bigenerina clavellata* LOEBLICH & TAPPAN – BARTENSTEIN & BOLLI, Trinidad *3,* 395; Pl. 1, Fig. 22–23.

Occurrence. – Upper Albian of Texas, Valanginian and Hauterivian of Europe.

Dorothia filiformis (BERTHELIN 1880)

Pl. 1, Fig. 37

1973 *Dorothia filiformis* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *3,* 397; Pl. 2, Fig. 32–35.
1977 *Dorothia filiformis* – BARTENSTEIN & BOLLI, Trinidad *4,* 564; Fig. 2.
1978 *Dorothia filiformis* (BERTHELIN) – BARTENSTEIN, Geol. en Mijnb. *57*/1, 22; Fig. 1–2.

Occurrence. – Worldwide Late Aptian and basal Albian, very rare.
Remarks. – The species is regarded as a successor of *Verneuilinoides subfiliformis* BARTENSTEIN.

Dorothia gradata (BERTHELIN 1880)

Pl. 1, Fig. 38–39

1973 *Dorothia gradata* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *3,* 397; Pl. 2, Fig. 52–56.
1977 *Dorothia gradata* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *4,* 549.

Occurrence. – Higher Lower Albian, persisting to Upper Cretaceous; a good index species with a worldwide distribution.

Gaudryina compacta GRABERT 1959

Pl. 1, Fig. 40–41

1959 *Gaudryina compacta* n. sp. – GRABERT, Abh. senckenb. natf. Ges. *498,* 11; Pl. 1, Fig. 6–8; Pl. 3, Fig. 48–52.
1978 *Gaudryina dividens* var. *compacta* GRABERT – GRADSTEIN, Init. Rep. Deep Sea Drill. Proj. *44,* 675; Pl. 2, Fig. 12–13.

Occurrence. – Common in the Lower Albian of the Alps (Austria, Tirol) and Sicily; presumably beginning in the Upper Aptian. Upper Aptian and Middle Albian offshore Florida according to GRADSTEIN (1978).

Remarks. – We agree with the determination by GRADSTEIN (1978) concerning the plexus of *Gaudryina dividens, G. dividens* var. *compacta* and *Spiroplectinata lata* from the Upper Aptian to Middle Albian of the western North Atlantic Ocean. But without more material, we cannot analyze any possible phylogenetic trend in the plexus.

Gaudryina dividens GRABERT 1959

Pl. 1, Fig. 42–43

1966 *Gaudryina dividens* GRABERT – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 141; Pl. 1, Fig. 56–57.
1973 *Gaudryina dividens* GRABERT – BARTENSTEIN & BOLLI, Trinidad *3*, 396.

Occurrence. – An excellent index foraminifer for Upper Aptian to Lower Albian in the boreal and tethyan realms.

Gaudryina klamathensis (DAILEY 1970)

Pl. 1, Fig. 44–45

1970 *Textularia klamathensis* n. sp. – DAILEY, Contr. Cushman Found. foram. Res. *21*/3, 103; Pl. 11, Fig. 2; Textfig. 3.
1973 *Textularia klamathensis* DAILEY – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 46; Pl. 2, Fig. 12.

Occurrence. – Originally described from the Upper Aptian to Lower Albian of California. In the *Hedbergella rohri* Zone of Trinidad rare, but with characteristic tests.
Remarks. – The initial part of the test is in most cases triserial. We therefore assign the species to *Gaudryina*. Because of the plate-like shape of the two final chambers it is possible that our specimens belong to a variety of the species.

Gaudryina reicheli BARTENSTEIN, BETTENSTAEDT & BOLLI 1966

Pl. 1, Fig. 46–47

1973 *Gaudryina reicheli* BARTENSTEIN, BETTENSTAEDT & BOLLI – BARTENSTEIN & BOLLI, Trinidad *3*, 396; Pl. 2, Fig. 36–51.
1982 *Gaudryina reicheli* BARTENSTEIN, BETTENSTAEDT & BOLLI – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 630; Pl. 1, Fig. 16.
1984 *Gaudryina reicheli* – MOULLADE, Benthos *83*, 440; Fig. 4.

Occurrence. – Upper Aptian (Clansayesian) in Bulgaria; probably a good index form in the tethyan realm.

Gaudryinella sherlocki BETTENSTAEDT 1952

Pl. 2, Fig. 1–2

1977 *Gaudryinella sherlocki* BETTENSTAEDT – BARTENSTEIN & BOLLI, Trinidad *4*, 547; Pl. 1, Fig. 21–22.
1979 *Gaudryinella sherlocki* BETTENSTAEDT – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 21; Pl. 4, Fig. 14.

Occurrence. – Upper Hauterivian to Lower Aptian in the Ukraine and Crimea. Worldwide from Upper Hauterivian to Lower Albian.

Haplophragmoides concavus (CHAPMAN 1893)

Pl. 1, Fig. 48–53

1977 *Haplophragmoides concavus* (CHAPMAN) – BARTENSTEIN & BOLLI, Trinidad *4*, 545; Pl. 1, Fig. 4–7.
1980 *Haplophragmoides concavus* (CHAPMAN) – GRADSTEIN, Init. Rep. Deep Sea Drill. Proj. *50*, Pl. 2, Fig. 1–2.

Occurrence. – Worldwide in the Lower Cretaceous. – See also *Trochammina depressa* Lozo 1944.

Haplophragmoides nonioninoides (REUSS 1863)

Pl. 2, Fig. 3–5

1965 *Haplophragmoides nonioninoides* (REUSS) – BARTENSTEIN, Senckenb. Lethaea *46*/4–6, 332.
1984 *Haplophragmoides nonioninoides* (REUSS) – GEROCH & NOWAK, Benthos *83*, 226; Pl. 2, Fig. 20, 21, 25; Pl. 5, Fig. 30, 31, 36–44.

Occurrence. – Higher Lower Cretaceous worldwide, e.g. Upper Aptian to Lower Cenomanian in Poland, Aptian to Lower Cenomanian in Germany and England.

Remarks. – Concerning the relatively large variability of the species including a plexus of related forms of *Haplophragmoides*, partly also of *Trochammina*, *Recurvoides* and *Plectorecurvoides*, we refer to BARTENSTEIN (1965: 332).

Marssonella oxycona (REUSS 1860)

Pl. 2, Fig. 6–7

1973 *Marssonella oxycona* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 396; Pl. 2, Fig. 62.

Occurrence. – Worldwide in the temperate and tethyan realms from Upper Aptian to Upper Cretaceous, in Trinidad from Upper Aptian to Albian. The species is a successor of *Marssonella praeoxycona* (MOULLADE 1966).

Marssonella subtrochus BARTENSTEIN 1962

Pl. 2, Fig. 8–10

1977 *Marssonella subtrochus* BARTENSTEIN – BARTENSTEIN & BOLLI, Trinidad *4*, 548; Pl. 1, Fig. 27–28.
1982 *Marssonella subtrochus* BARTENSTEIN – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 631; Pl. 1, Fig. 22–23; Pl. 5, Fig. 17–18.
1984 *Dorothia subtrochus* (BARTENSTEIN) – MOULLADE, Benthos *83*, 462; Pl. 10, Fig. 10–13.

Occurrence. – A worldwide index foraminifer in the temperate and tethyan realms from Middle Barremian to Cenomanian.

Plectorecurvoides alternans NOTH 1952

· Pl. 2, Fig. 11–13

1977 *Plectorecurvoides alternans* NOTH – KRASHENINNIKOV & PFLAUMANN, Init. Rep. Deep Sea Drill. Proj. *41*, 570; Pl. 5, Fig. 6.
1984 *Plectorecurvoides alternans* NOTH – GEROCH & NOWAK, Benthos *83*, 226; Table 1; Pl. 2, Fig. 26; Pl. 6, Fig. 5.
1984 *Plectorecurvoides alternans* – MOULLADE, Benthos *83*, 440; Fig. 4; Textfig. 4.

Occurrence. – Aptian and Albian of the Morocco Basin; higher Albian to Turonian in the Polish Carpathian Flysch, common.

Remarks. – Because of the variable state of preservation, coiling and sequence of chambers, genus and species assignment remains uncertain. *Labrospira?* cf. *pacifica* in the Albian and Cenomanian of Poland, *Plectorecurvoides irregularis* in the Barremian to Cenomanian of Poland, *Recurvoides imperfectus* in the Albian to Cenomanian of Poland belong according to GEROCH & NOWAK (1984) to a common genetic plexus of tests which is planispiral in the young portion, but irregular in the later stage. See also *Haplophragmoides nonioninoides.*

Textularia bettenstaedti BARTENSTEIN & OERTLI 1977

Pl. 2, Fig. 14–15

1977 *Textularia bettenstaedti* n.sp. – BARTENSTEIN & OERTLI, N. Jb. Geol. Paläont. [Mh.] *1*, 15–24.
1981 *Textularia bettenstaedti* BARTENSTEIN & OERTLI – BARTENSTEIN, N. Jb. Geol. Paläont. [Abh.] *161*/3, 310.
1982 *Textularia bettenstaedti* BARTENSTEIN & OERTLI – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 632; Pl. 1, Fig. 24–25.

Occurrence. – Worldwide in the boreal and tethyan realms, common in the Upper Aptian and Lower Albian, rare in the Lower Aptian and lowermost Middle Albian. This index foraminifer is a time equivalent of *Lenticulina (S.) spinosa* (EICHENBERG 1935) and of *Gaudryina dividens* GRABERT 1959, both species reported in Trinidad *2, 3, 4* and *5.*

Remarks. – The tests in the Lower Cretaceous of Trinidad resemble the European tests, e.g. in the incorporation of "coal dust" crystals (BARTENSTEIN & OERTLI 1977: 16–17).

Tritaxia plummerae CUSHMAN 1936

Pl. 2, Fig. 16–18

1943 *Tritaxia plummerae* CUSHMAN – TAPPAN, J. Paleont. *17*/5, 487; Pl. 78, Fig. 17–21.
1943 *Gaudryina alexanderi* CUSHMAN – TAPPAN, J. Paleont. *17*/5, 488; Pl. 78, Fig. 22–27.
1943 *Gaudryina subcretacea* CUSHMAN – TAPPAN, J. Paleont. *17*/5, 490; Pl. 78, Fig. 28–29.
1950 *Tritaxia plummerae* CUSHMAN – DAM, Mém. Soc. géol. France [n.s.] *29*/4, 12; Pl. 1, Fig. 12.
1965 *Tritaxia plummerae* CUSHMAN – NEAGU, Micropaleontology *11*/1, 5; Pl. 1, Fig. 9–10.

Occurrence. – Worldwide in the Middle and Upper Albian, known from the Lower Washita Group in Texas, corresponding to the lower Upper Albian in Europe; (Middle?) Albian of the Netherlands; middle portion of the Middle Albian in Rumania. This first discovery of *Tritaxia plummerae* in Trinidad therefore shifts the beginning of the species to the basal Albian.

Trochammina depressa LOZO 1944

Pl. 2, Fig. 19

1977 *Trochammina depressa* LOZO – BARTENSTEIN & BOLLI, Trinidad *4*, 549; Pl. 1, Fig. 29–31.

Occurrence. – Worldwide in the Lower Cretaceous.

Remarks. – The species is similar to *Haplophragmoides concavus* (CHAPMAN) in that the chambers are strongly to completely compressed and most tests asymmetrically deformed. It is not possible therefore to distinguish the rather primitively constructed tests of these two species.

Trochammina sp.

Pl. 2, Fig. 20

Remarks. – Test free, small and compressed, trochoid, dorsally gently convex, periphery rounded, wall coarsely arenaceous, aperture not visible. Two whorls visible on the spiral side, sutures oblique, but relatively indistinct.

Valvulina fusca (WILLIAMSON 1858)

Pl. 2, Fig. 21–22

1973 *Valvulina fusca* (WILLIAMSON)(?) – BARTENSTEIN & BOLLI, Trinidad *3*, 398; Pl. 3, Fig. 27–28.

Occurrence. – A worldwide index foraminifer in the temperate and tethyan realms from Middle Barremian to Cenomanian. – See remarks in Trinidad *3*, 398 (1973).

Verneuilinoides subfiliformis BARTENSTEIN 1952

Pl. 2, Fig. 23–25

1973 *Verneuilina* sp. – BARTENSTEIN & BOLLI, Trinidad *3*, 395; Pl. 2, Fig. 27–31.
1977 *Verneuilinoides subfiliformis* BARTENSTEIN – BARTENSTEIN & BOLLI, Trinidad *4*, 546; Pl. 1, Fig. 15–17.

Occurrence. – Worldwide from Upper Hauterivian to Lower Albian. The species is a successor of *Verneuilinoides neocomiensis* (MJATLIUK 1939) and a predecessor of *Dorothia filiformis* (BERTHELIN 1880).

CALCAREOUS BENTHIC FORAMINIFERA

Superfamily Miliolacea

Agathammina sp.?

Pl. 2, Fig. 26–27

Occurrence. – Carboniferous, Pennsylvanian, to Jurassic. If the existing material belongs to the genus *Agathammina*, it would be the youngest occurrence known.
Remarks. – Test free, tubular, undivided, irregularly coiled around an elongate axis; wall calcareous, imperforate; aperture at the open end of the tubular chamber.

Occurrence of the genus *Quinqueloculina* ORBIGNY 1826 in the Lower Cretaceous of Trinidad

We confirm the explanations in BARTENSTEIN & KOVATCHEVA (1982: 634–635) concerning occurrence, construction and preservation of forms of the genus *Quinqueloculina* in the Jurassic, Lower Cretaceous and basal Upper Cretaceous. Our mostly undersized, hyaline, thin and translucent tests give the impression of small or juvenile rather than of fully-grown and well developed forms. Similar observations apply to *Quinqueloculina* and other genera of the family Miliolidae in the Lower Cretaceous all over the world.

In the Lower Cretaceous, *Quinqueloculina* may be restricted to warm seas with shallow to medium depths.

Quinqueloculina sabella LOEBLICH & TAPPAN 1946

Pl. 2, Fig. 28

1946 *Quinqueloculina sabella* n.sp. – LOEBLICH & TAPPAN, J. Paleont. *20*, 247; Pl. 35, Fig. 20.

Occurrence. – Upper Albian and? basal Cenomanian of Texas, Washita Group.

Remarks. – Together with *Quinqueloculina aeschria* LOEBLICH & TAPPAN 1946 from the same type locality, this species belongs to a plexus which may include also other *Quinqueloculina* species published from the higher Albian to basal Upper Cretaceous of North America and elsewhere.

Quinqueloculina sp.?

Pl. 2, Fig. 29–30

Remarks. – The undersized, thin and translucent tests may belong to juvenile specimens of the genus *Quinqueloculina.* But they may also belong to *Agathammina* (Pl. 2, Fig. 26–27).

Superfamily Nodosariacea

Remarks on the genera *Nodosaria* ORBIGNY and *Dentalina* ORBIGNY

As noted by REUSS (1860: 181) and other authors, the great variability of species of *Nodosaria* and *Dentalina* in the Cretaceous makes it impossible to clearly separate these two genera. This applies also to specimens of *Nodosaria* and *Dentalina* in the Cretaceous of Trinidad where it is often difficult to place certain specimens into one or the other genus.

Another problem is the variable size and growth of tests, such as in *Dentalina catenula, D. communis, D. cylindroides* and *D. distincta* (see BARTENSTEIN & BOLLI, Trinidad *3,* 404–405, and the present material).

Dentalina aequivoca (REUSS 1863)

Pl. 2, Fig. 31

1863 *Marginulina aequivoca* m. – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *46,* 60; Pl. 5, Fig. 17.

Occurrence. – Middle Albian, *Minimus* Clay, of northwestern Germany; Middle and Upper Albian, England, always very rare.

Remarks. – The only test is a fragment without initial part. It has 6 ribs.

Dentalina bonaccordensis n.sp.

Pl. 2, Fig. 32–34

1966 *Dentalina* cf. *porcatulata* LOEBLICH & TAPPAN – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2,* 154; Pl. 3, Fig. 226.

Derivation of name. – From Bon Accord Hill as the type locality.

Holotype. – Specimen Plate 2, Figure 32. – Length: 1.35 mm. – C 36264.

Paratypes. – Specimens Plate 2, Figure 33–34. – Length: 0.95–0.75 mm. – C 36265–36266.

Type locality. – Trinidad, Bon Accord Trench, Pointe-à-Pierre.

Type horizon. – *Hedbergella rohri* Zone.

Diagnosis. – A species of the genus *Dentalina* ornamented with about 10–14 low, thin ribs without bifurcation during growth of the test.

Description. – Test free, very long, subcylindrical, slightly but irregularly curved, tapering only slightly; chambers increasing gradually in size; sutures distinct, slightly depressed, wall calcareous; test bluntly pointed at base, surface ornamented with about 10–14 low, thin ribs without any bifurcation; aperture subterminal on a short neck; radial when not broken. Number of chambers: holotype 7, paratypes 6 and 4.

Remarks. – The new species is similar to *Nodosaria bifurcata* TAPPAN 1940 from the Grayson Formation of northern Texas, corresponding to the Uppermost Albian and basal Cenomanian in Europe, but has no bifurcation of the ribs and is a typical *Dentalina*. No relationship exists to *Dentalina porcatulata* LOEBLICH & TAPPAN 1951 from the Lower Cenomanian, Maness Shale, in Texas.

Occurrence. – Upper Aptian (Trinidad *2*) to Lower Albian in Trinidad, rare.

Dentalina catenula REUSS 1860

Pl. 2, Fig. 35

1860 *Dentalina catenula* m. – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *40,* 184; Pl. 3, Fig. 6.
1928 *D. catenula* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N. F.] *111,* 26; Pl. 2, Fig. 16.
1928 *D. cognata* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N. F.] *111,* 26; Pl. 2, Fig. 15.
non 1954 *Dentalina catenula* REUSS – FRIZZELL, Rep. Invest. Bur. econ. Geol. Univ. Texas *22,* 87; Pl. 9, Fig. 35–37.

Occurrence. – Originally described from the Upper Gault, Upper Albian, and higher Upper Cretaceous of Westphalia, northwestern Germany; occurring in the Taylor Group of Texas.

Remarks. – We cannot find any evident distinction between the two species *Dentalina catenula* and *D. cognata,* also with regard to age and type localities in Westphalia and therefore we use *D. catenula.*

Dentalina communis ORBIGNY 1826

Pl. 2, Fig. 36–37

1973 *Dentalina communis* ORBIGNY – BARTENSTEIN & BOLLI, Trinidad *3,* 404; Pl. 5, Fig. 45–46.
1982 *Dentalina communis* D'ORBIGNY – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 636; Pl. 2, Fig. 4–5.

Occurrence. – In Texas Fredericksburg and Washita Groups corresponding to Middle and Upper Albian in Europe; in northwestern California Barremian to Cenomanian; in Trinidad Barremian to Albian; worldwide throughout the Cretaceous and persisting into the Tertiary, common to rare.

Dentalina cylindroides REUSS 1860

Pl. 2, Fig. 38–39

1973 *Dentalina cylindroides* REUSS – BARTENSTEIN & BOLLI, Trinidad *3*, 405; Pl. 5, Fig. 25–35.
1973 *Dentalina cylindroides* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 63; Pl. 8, Fig. 17.
1973 *Dentalina catenula* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 63; Pl. 8, Fig. 15.

Occurrence. – In Texas throughout the Washita Group corresponding to top Middle Albian to basal Cenomanian; in northwestern California higher Lower Cretaceous and basal Cenomanian; worldwide in the higher Lower Cretaceous and basal Upper Cretaceous.

Dentalina debilis (BERTHELIN 1880)

1957 *Dentalina debilis* (BERTHELIN) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1*, 35; Pl. 7, Fig. 149.
1982 *Dentalina debilis* (BERTHELIN) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 636; Pl. 2, Fig. 3.
1984 *Lenticulina (Vaginulina) debilis* (BERTHELIN) – MOULLADE, Benthos *83*, 448; Pl. 3, Fig. 13.

Occurrence. – Worldwide in the Lower Cretaceous, relatively characteristic in the Albian of Europe, Albian and basal Cenomanian of Texas and Kansas, Albian in the western North Atlantic, Barremian and Upper Aptian to Lower Albian in Trinidad where only fragments consisting of two or three chambers are known.

Dentalina distincta REUSS 1860

Pl. 2, Fig. 40–41

1973 *Dentalina distincta* REUSS – BARTENSTEIN & BOLLI, Trinidad *3*, 405; Pl. 5, Fig. 36–42.
1982 *Dentalina distincta* REUSS – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 637; Pl. 2, Fig. 6–7.

Occurrence. – Originally described from the Albian and Upper Cretaceous in Westphalia; worldwide from higher Barremian to Upper Cretaceous of the temperate and tethyan realms.

Remarks. – Transitional forms exist between *Dentalina distincta, D. cylindroides, D. cognata* and *D. catenula,* all of which occur in the higher Albian and Upper Cretaceous.

Dentalina expansa REUSS 1860

Pl. 2, Fig. 42–43

1893 *Nodosaria (D.) expansa* REUSS – CHAPMAN, J. r. microsc. Soc. *13*, 586; Pl. 8, Fig. 24.

Occurrence. – Senonian of Westphalia, Middle and Upper Albian of England.

Remarks. – Only preserved as fragments, mostly one (Fig. 43) or very rarely two chambers (Fig. 42). CHAPMAN 1893, p. 586, says: "This form is represented by fragments only; and it was in this condition that REUSS found it."

Dentalina filiformis REUSS 1845

Pl. 3, Fig. 1–3

1860 *D. filiformis* REUSS – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *40*, 188; Pl. 3, Fig. 8.

1928 *D. filiformis* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N. F.] *111*, 29; Pl. 2, Fig. 19.
1970 *Nodosaria filiformis* REUSS – NEAGU, Mem. Inst. Geol. (Bucarest) *12*, 45; Pl. 9, Fig. 1.

Occurrence. – Upper Cretaceous of Europe and California.

Remarks. – Because of the fragile nature of the test, complete specimens are very rare. This was also observed by FRANKE (1928). The oblique sutures support the assignment to *Dentalina.*

Dentalina gracilis ORBIGNY 1839

Pl. 3, Fig. 4–6

1973 *Dentalina gracilis* ORBIGNY – BARTENSTEIN & BOLLI, Trinidad *3*, 404.
1982 *Dentalina gracilis* D'ORBIGNY – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 637; Pl. 2, Fig. 8–9.
1984 *Dentalina gracilis* D'ORBIGNY – MOULLADE, Benthos *83*, 446; Pl. 2, Fig. 14.

Occurrence. – Trinidad Barremian to Albian; northwestern California Barremian to Cenomanian; Texas throughout the Upper Cretaceous. *Dentalina gracilis,* originally described in the "Craie blanche" of France, is known worldwide from the higher Lower Cretaceous and Upper Cretaceous.

Dentalina linearis (ROEMER 1841)

Pl. 3, Fig. 7–8

1973 *Dentalina linearis* (ROEMER) – BARTENSTEIN & BOLLI, Trinidad *3*, 405; Pl. 5, Fig. 59–60.
1979 *Dentalina linearis* (ROEMER) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 51; Pl. 13, Fig. 3.
1982 *Dentalina linearis* (ROEMER) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 637; Pl. 2, Fig. 11.

Occurrence. – Trinidad Barremian to Albian; originally described as *Nodosaria* in the Hauterivian of northwestern Germany; worldwide in the Lower Cretaceous.

Remarks. – Specimens are transitional between *Dentalina* and *Nodosaria;* see remarks on the genera *Dentalina* and *Nodosaria* (p. 955).

Dentalina nana REUSS 1863

Pl. 2, Fig. 44–46

1973 *Dentalina nana* REUSS – BARTENSTEIN & BOLLI, Trinidad *3*, 404; Pl. 5, Fig. 61–63.
1984 *Dentalina nana* REUSS – MOULLADE, Benthos *83*, 446; Pl. 2, Fig. 1.

Occurrence. – Trinidad Barremian to Albian; worldwide throughout the Cretaceous.

Dentalina aff. *oligostegia* (REUSS 1845)

Pl. 3, Fig. 9–10

1928 *D. oligostegia* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N. F.] *111*, 24; Pl. 2, Fig. 9–10.
1975 *Dentalina oligostegia* (REUSS) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 95; Pl. 72, Fig. 35–38; Pl. 73, Fig. 24–31.
1984 *Dentalina oligostegia* (REUSS) – MOULLADE, Benthos *83*, 446; Pl. 2, Fig. 16.

Occurrence. – Worldwide in the Cretaceous.

Remarks. – According to FRANKE (1928: 25) *Dentalina oligostegia* includes two and three chambered juvenile forms of smooth *Dentalina* and *Nodosaria* with a central spine. There is no possibility in the Cretaceous to allocate these tests to either *Dentalina* or *Nodosaria* or to a definite species.

Dentalina soluta REUSS 1851

Pl. 3, Fig. 11–12

1973 *Dentalina soluta* REUSS – BARTENSTEIN & BOLLI, Trinidad *3*, 404; Pl. 5, Fig. 57–58.
1973 *Dentalina soluta* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 64; Pl. 9, Fig. 4.
1984 *Nodosaria soluta* (REUSS) – MOULLADE, Benthos *83*, 444; Pl. 1, Fig. 10.

Occurrence. – Originally described from the Tertiary Septarian Clay in North Germany, it also occurs in the Lower Cretaceous of northwestern Germany and northwestern Europe, further in the Aptian to Cenomanian of California. The species is mostly sporadic and infrequent.

Dentalina torta TERQUEM 1858 from the Liassic in Lorraine is a synonym of *Dentalina soluta*.

Dentalina subguttifera BARTENSTEIN 1952

Pl. 3, Fig. 13

1973 *Dentalina subguttifera* BARTENSTEIN – BARTENSTEIN & BOLLI, Trinidad *3*, 405; Pl. 5, Fig. 43–44.
1982 *Dentalina guttifera* D'ORBIGNY – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 637; Pl. 2, Fig. 10.

Occurrence. – Trinidad Barremian to Albian; northwestern Germany Barremian; Bulgaria Bedoulian, mostly very rare.

Dentalina cf. *terquemi* ORBIGNY 1850

Pl. 3, Fig. 14–15

1952 *Dentalina terquemi* ORBIGNY – BETTENSTAEDT, Senckenbergiana *33*/4–6, 273; Pl. 2, Fig. 19–21.
1967 *Dentalina terquemi* D'ORBIGNY – MICHAEL, Palaeontographica, suppl. *12*, 63; Pl. 5, Fig. 12.

Occurrence. – Liassic to Upper Cretaceous, mostly very rare. The species is locally of significance in the Middle Barremian of northwestern Germany.

Remarks. – Only two fragments are present in the investigated *Hedbergella rohri* Zone material. They represent the middle portion of tests with the characteristic arrangement of the chambers.

According to MICHAEL (1967), *Enantiodentalina communis* (D'ORBIGNY) by DAM (1950: 41) from the Albian of the Netherlands belongs to *Dentalina terquemi*.

Flabellinella didyma (BERTHELIN 1880)

Pl. 3, Fig. 41

1973 *Citharinella didyma* (BERTHELIN) – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 70; Pl. 10, Fig. 8.
1975 *Citharinella didyma* (BERTHELIN) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 78; Pl. 67, Fig. 23.

Occurrence. – Worldwide in the Lower Cretaceous.

Remarks. – Only one fragment but with the characteristic initial part was found in the *Hedbergella rohri* Zone.

Citharinella MARIE 1938 seems to be very close or synonymous to *Flabellinella* SCHUBERT 1900.

Frondicularia gaultina REUSS 1860

Pl. 3, Fig. 42–43

1973 *Frondicularia gaultina* REUSS – BARTENSTEIN & BOLLI, Trinidad *3*, 406; Pl. 6, Fig. 1–2.

1979 *Frondicularia gaultina* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 35; Pl. 7, Fig. 9.

Occurrence. – Aptian to Cenomanian in Europe and other areas; in the Soviet Union known from the Upper Albian; in Trinidad Barremian to Albian.

Remarks. – The variability of *Frondicularia gaultina* is relatively large and concerns the flat or slightly depressed sutures and the subrhomboidal or more lanceolate outline of the test. Transitional forms exist between *Frondicularia* and *Flabellinella* (Fig. 43).

Lagena apiculata (REUSS 1851)

Pl. 3, Fig. 44–45

1973 *Oolina apiculata* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 71; Pl. 10, Fig. 13.

1982 *Lagena* aff. *apiculata* (REUSS 1851) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 639; Pl. 2, Fig. 23–25; Pl. 5, Fig. 21.

Occurrence. – Worldwide in the Jurassic and Cretaceous, common to rare.

Lagena globosa (MONTAGU 1803)

Pl. 3, Fig. 46–48

1951 *Lagena globosa* (MONTAGU) – BARTENSTEIN & BRAND, Abh. senckenb. natf. Ges. *485*, 318.

1967 *Lagena globosa* (MONTAGU) – MICHAEL, Palaeontographica, suppl. *12*, 75; Pl. 11, Fig. 2.

1984 *Lagena globosa* (MONTAGU) – MOULLADE, Benthos *83*, 448; Pl. 3, Fig. 17.

Occurrence. – Worldwide from Jurassic to Recent, common to rare.

Lagena laevis (MONTAGU 1803)

Pl. 4, Fig. 1–3

1966 *Lagena laevis* (MONTAGU) – BARTENSTEIN & BOLLI, Trinidad *2*, 157; Pl. 3, Fig. 279–285.

Occurrence. – Worldwide from Triassic to Recent, common to rare.

Remarks. – A close relationship exists between *Lagena globosa* (shape globose) and *Lagena laevis* (shape ovate, pyriform).

Lagena aff. *oxystoma* REUSS 1858

Pl. 4, Fig. 4–6

1940 *Lagena hispida* REUSS var. – TAPPAN, J. Paleont. *14*/2, 112; Pl. 17, Fig. 16.

1951 *Lagena* cf. *oxystoma* REUSS – BARTENSTEIN & BRAND, Abh. senckenb. natf. Ges. *485*, 318; Pl. 10, Fig. 331; Pl. 13, Fig. 354–356.
1967 *Lagena oxystoma* REUSS – MICHAEL, Palaeontographica, suppl. *12*, 75; Pl. 4, Fig. 33.

Occurrence. – Jurassic to Recent worldwide, common to rare.

Remarks. – Because of the polymorphic shapes, the heterogeneous development of the apertures and the wall (smooth, rough or finely to coarsely spinose), discrepancies exist in the allocation to a certain species.

Lenticulina LAMARCK 1804

Abbreviations for the subgenera of *Lenticulina: (L.) = Lenticulina, (A.) = Astacolus, (V.) = Vaginulinopsis, (M.) = Marginulinopsis, (S.) = Saracenaria, (P.) = Planularia*

Reliable specific determinations of various, as a rule unornamented, Lenticulinae are in many cases nearly impossible. Some species are no more than locally developed and limited forms, frequently with similar shape of test and chamber ornamentation. This problem is well known for the Lenticulinae from the Jurassic to the Tertiary.

Apart from ROEMER (1841, 1842) and KOCH (1851), REUSS (1860, 1863) was the first to describe the Lower Cretaceous foraminifera of northwestern Germany in detail, including a large number of Lenticulinae (formerly: *Cristellaria, Robulina*) and transitional forms to the subgenera *Marginulinopsis, Vaginulinopsis, Astacolus, Saracenaria* and/or *Planularia*. They include sixty species, most of them new, from the "Hils" and "Gault" of North Germany, belonging to the Hauterivian (Hils), Barremian (Speeton), Aptian (Gargas), Lower Albian (*Tardefurcatus* and *Milletianus* zones), Middle Albian (*Minimus* Zone) and Upper Albian (Flammenmergel) in present day terminology.

Lenticulina (L.) acuta (REUSS 1860)

Pl. 4, Fig. 7–8

1973 *Lenticulina (L.) acuta* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 400; Pl. 4, Fig. 13–22.

Occurrence. – Common in the Albian of northwestern Germany, but rare in the Barremian and basal Upper Cretaceous.

Remarks. – See Trinidad *2*, p. 146, concerning the unsatisfactory distinction of *Lenticulina acuta* and *L. nuda* (REUSS 1861), and our introductory remarks to *Lenticulina* above.

Lenticulina (L.) antillica n.sp.

Pl. 5, Fig. 13–14

Holotype. – Specimen Plate 5, Figure 14. – L: 1.17 mm. – C 36376.

Paratype. – Specimen Plate 5, Figure 13. – L: 1.12 mm. – C 36375.

Type locality. – Trinidad, Bon Accord Trench, Pointe-à-Pierre.

Type horizon. – *Hedbergella rohri* Zone.

Diagnosis. – A species of the genus *Lenticulina (L.)* with a relatively large test and up to 16 interrupted costae on the lateral sides.

Description. – Test free, planispiral and distinctly flattened, involute, sharply keeled. Nine chambers in the last whorl, sutures depressed, the numerous vigorous ribs interrupted and without bifurcation, partially crossing the sutures. Umbilical area depressed, aperture radiate at the peripheral angle. The tests show no tendency to become uncoiled.

Remarks. – No similarity exists to other Lower Cretaceous *Lenticulina (L.)*.

Occurrence. – Late Aptian to earliest Albian *Hedbergella rohri* Zone of Trinidad.

Lenticulina (A.) calliopsis (Reuss 1863)

Pl. 4, Fig. 9–10

1973 *Lenticulina (A.) calliopsis* (Reuss) – Bartenstein & Bolli, Trinidad *3*, 402; Pl. 5, Fig. 1–10.
1982 *Lenticulina (A.) calliopsis* (Reuss) – Bartenstein & Kovatcheva, Eclogae geol. Helv. *75*/3, 640; Pl. 2, Fig. 28.

Occurrence. – Typically developed in the high Lower Cretaceous.

Lenticulina caribica n.sp.

Pl. 5, Fig. 10–12

Holotype. – Specimen Plate 5, Figure 10. – L: 1.3 mm. – C 36372.

Paratypes. – Specimens Plate 5, Figures 11–12. – L: 1.05–0.6 mm. – C 36373–36374.

Type locality. – Trinidad, Bon Accord Trench, Pointe-à-Pierre.

Type horizon. – *Hedbergella rohri* Zone.

Diagnosis. – A species of the genus *Lenticulina* (transitional between the subgenera *Vaginulinopsis* and *Marginulinopsis*) with 22–26 ribs all round the test.

Description. – Test free, planispiral and bilaterally symmetrical, earliest portion closely coiled, later becoming uncoiled, rectilinear and somewhat compressed. 22–26 ribs all round the test, disappearing at about the midline of the final chamber. No bifurcation of the ribs is perceivable. Peripheral margin distinctly keeled, frontal side rounded, aperture radiate at the dorsal angle of the test. Sutures distinct, depressed, ribs partially crossing the sutures.

Remarks. – The three rather large specimens present show no relationship to other Lower Cretaceous *Vaginulinopsis* or *Marginulinopsis* species.

Occurrence. – Late Aptian to earliest Albian *Hedbergella rohri* Zone of Trinidad.

Lenticulina (M.) cephalotes (Reuss 1863)

Pl. 4, Fig. 11–12

1973 *Lenticulina (M.) cephalotes* (Reuss) – Bartenstein & Bolli, Trinidad *3*, 403; Pl. 4, Fig. 41–44.

Occurrence. – First described from the Hauterivian and Albian of northwestern Germany; known from the Lower and lower Upper Cretaceous.

Lenticulina (P.) complanata (Reuss 1845)

Pl. 4, Fig. 13

1928 *Cr. complanata* Reuss – Franke, Abh. preuss. geol. Landesanst. [N.F.] *111*, 101; Pl. 9, Fig. 18–19.
1954 *Citharina complanata* (Reuss) var. *complanata* (Reuss) – Frizzell, Rep. Invest. Bur. econ. Geol. Univ. Texas *22*, 94; Pl. 11, Fig. 2.

Occurrence. – Albian and Upper Cretaceous of Europe; top Albian and basal Cenomanian of Texas, very rare.

Lenticulina (L.) gaultina (BERTHELIN 1880)

Pl. 4, Fig. 14–15

1954 *Lenticulina gaultina* (BERTHELIN) – FRIZZELL, Rep. Invest. Bur. econ. Geol. Univ. Texas *22*, 82; Pl. 8, Fig. 15.
1979 *Lenticulina gaultina* (BERTHELIN) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 38; Pl. 8, Fig. 7.
1982 *Lenticulina (L.) gaultina* (BERTHELIN) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 641; Pl. 3, Fig. 1–2.

Occurrence. – In Texas throughout the Washita and Woodbine Group corresponding to the Upper Albian and Cenomanian of Europe; in northwestern Germany and Europe Aptian and Albian; in the Ukraine, Emba region and Caucasus Albian. A good index form for the higher Lower Cretaceous in the temperate and tethyan realms.

Remarks. – The species has developed from *Lenticulina (L.) subgaultina* BARTENSTEIN 1962.

Lenticulina (A.) grata (REUSS 1863)

Pl. 4, Fig. 16

1966 *Lenticulina (A.) grata* (REUSS) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 148; Pl. 2, Fig. 130–133.
1979 *Astacolus gratus* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 43; Pl. 10, Fig. 9.

Occurrence. – Higher Lower Cretaceous, first described from the Lower Albian in northwestern Germany. In Trinidad Barremian to Albian; in the Ukraine entire Lower Cretaceous, common in the Albian.

Lenticulina (M.) inaequalis (REUSS 1860)

Pl. 4, Fig. 17–18

1863 *Marginulina inaequalis* REUSS – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *46*, 59; Pl. 5, Fig. 13; Pl. 6, Fig. 8.

Occurrence. – First described from the Upper Albian in northwestern Germany.

Lenticulina (V.) incurvata (REUSS 1863)

Pl. 4, Fig. 19–21

1973 *Lenticulina (V.) incurvata* (REUSS 1863) – BARTENSTEIN & BOLLI, Trinidad *3*, 402; Pl. 5, Fig. 21–24.
1984 *Lenticulina (Astacolus) incurvata* (REUSS) – MOULLADE, Benthos *83*, 446; Pl. 2, Fig. 17.

Occurrence. – Originally described from the Barremian and Albian in Northwest Germany; in Trinidad known from Barremian to Lower Albian, rare to infrequent.

Remarks. – For test morphology and variability see remarks in Trinidad *2*, 148–150, and Trinidad *3*, 402–403. *Lenticulina latifrons* (BRADY) in CHAPMAN 1894, Folkestone 7, from the Albian of Folkestone appears to be closely related to *Lenticulina (V.) incurvata*.

Lenticulina (M.) lituola (REUSS 1846)

Pl. 4, Fig. 22–23

1973 *Lenticulina (M.) lituola* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 403.
1979 *Lenticulina lituola* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 39; Pl. 8, Fig. 11.

Occurrence. – Aptian to lower Upper Cretaceous in Europe; Upper Barremian, Aptian and Paleogene in the Soviet Union.

Lenticulina (L.) meridiana BARTENSTEIN, BETTENSTAEDT & KOVATCHEVA 1971

Pl. 4, Fig. 24

1973 *Lenticulina (L.) meridiana* BARTENSTEIN, BETTENSTAEDT & KOVATCHEVA – BARTENSTEIN & BOLLI, Trinidad *3*, 399; Pl. 3, Fig. 40.
1977 *L. (L.) meridiana* BARTENSTEIN & BOLLI, Trinidad *4*, 562, 564.

Occurrence. – Barremian to Lower Albian in Trinidad, rare.
Remarks. – Transitional forms exist between *L. (L.) meridiana* and *L. (L.) saxocretacea* BARTENSTEIN 1954.

Lenticulina (L.) muensteri (ROEMER 1839)

Pl. 4, Fig. 25–26

1957 *Lenticulina (L.) münsteri* (ROEMER) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1*, 22; Pl. 3, Fig. 54; Pl. 4, Fig. 80–81.
1979 *Lenticulina muensteri* (ROEMER) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 39; Pl. 9, Fig. 3.
1982 *Lenticulina (L.) muensteri* (ROEMER) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 642; Pl. 3, Fig. 4–5.

Occurrence. – Worldwide in the Jurassic and Cretaceous, an ordinary and common species, recorded under various species names.
Remarks. – Transitional forms exist between *L. (L.) muensteri*, *L. (L.) cultrata* (MONTFORT), *L. (L.) rotulata* (LAMARCK), *L. (L.) macrodisca* (REUSS), *L. (L.) roemeri* (REUSS) and *L. (L.) subalata* (REUSS) which makes it impossible to establish morphologically and stratigraphically distinct groups.

Lenticulina (A.) perobliqua (REUSS 1863)

Pl. 4, Fig. 27–29

1863 *Cr. perobliqua* m. – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *46*, 67; Pl. 7, Fig. 3.

Occurrence. – Originally described from the Middle Albian, *Minimus* Clay, of northwestern Germany, very rare.
Remarks. – *L. (A.) perobliqua* is one of the Albian species with a relatively great variability of the tests. Transitional forms to *L. (A.) incurvata* and *L. (A.) strombecki* are possible. In many cases, the spiral initial part is missing or poorly developed.

Lenticulina (M.) robusta (REUSS 1863)

Pl. 4, Fig. 30–31

1951 *Lenticulina (M.) robusta* (REUSS) – BARTENSTEIN & BRAND, Abh. senckenb. natf. Ges. *485*, 289; Pl. 6, Fig. 142, 143.
1957 *Lenticulina (M.)* sp. – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1*, 32; Pl. 6, Fig. 122.

Occurrence. – Lower Cretaceous worldwide; in Trinidad very rare in the Barremian (Trinidad *1*), common in the *Hedbergella rohri* Zone.

Remarks. – The species shows great variability (BARTENSTEIN & BRAND 1951), especially with regard to the number, thickness, height and arrangement of the ribs.

Lenticulina (L.) roemeri (REUSS 1863)

Pl. 5, Fig. 1

1957 *Lenticulina (L.) roemeri* (REUSS) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1*, 23; Pl. 5, Fig. 93.

Occurrence. – Originally described from the Hauterivian, Barremian and Albian of northwestern Germany; worldwide in the Lower Cretaceous; in Trinidad Barremian to Lower Albian.

Lenticulina (L.) saxocretacea BARTENSTEIN 1954

Pl. 4, Fig. 32–34

1973 *Lenticulina (L.) saxocretacea* BARTENSTEIN – BARTENSTEIN & BOLLI, Trinidad *3*, 399; Pl. 3, Fig. 36–39.
1982 *Lenticulina (L.)* aff. *saxocretacea* BARTENSTEIN – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 642; Pl. 3, Fig. 11–12.

Occurrence. – Barremian to Albian of the boreal and tethyan realms in Europe and in Trinidad, rare to infrequent.

Remarks. – As reported in Trinidad *3*, 399, our material also contains specimens in which the sutural ridges show incipient pustules and are therefore transitional to *Lenticulina (L.) meridiana.*

Lenticulina (A.) schloenbachi (REUSS 1863)

Pl. 4, Fig. 35–36

1982 *Lenticulina (A.) schloenbachi* (REUSS) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 640, Pl. 2, Fig. 35.

Occurrence. – Lower Cretaceous worldwide; in Trinidad Barremian to Lower Albian.

Remarks. – Numerous specimens are transitional to other *Lenticulina* species, e.g. *L. (A.) scitula* (BERTHELIN), *L. (A.) grata* (REUSS) and *L. (A.) calliopsis* (REUSS).

Lenticulina (A.) scitula (BERTHELIN 1880)

Pl. 5, Fig. 2–4

1973 *Lenticulina (A.) scitula* (BERTHELIN 1880) – BARTENSTEIN & BOLLI, Trinidad *3*, 402; Pl. 5, Fig. 16–20.
1982 *Lenticulina (A.) scitula* (BERTHELIN) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 641; Pl. 2, Fig. 36–37.

Occurrence. – A cosmopolitan species of the higher Lower Cretaceous in the boreal and tethyan realms; in Trinidad Barremian to Lower Albian.

Lenticulina (L.) secans (REUSS 1860)

1975 *Lenticulina secans* (REUSS) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 64; Pl. 47, Fig. 5–8.
1982 *Lenticulina (L.) secans* (REUSS) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 643; Pl. 3, Fig. 13–14.

Occurrence. – First described from the Albian of northwestern Germany.

Lenticulina (L.) strombecki (REUSS 1863)

1973 *Lenticulina (L.) strombecki* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 400.
1979 *Astacolus strombecki* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK: Inst. Geol. NAUK (Kiev) 44; Pl. 9, Fig. 8.

Occurrence. – Entire Lower Cretaceous, worldwide, rare.

Lenticulina (L.) turgidula (REUSS 1863)

Pl. 5, Fig. 5–6

1973 *Lenticulina (L.) turgidula* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 400; Pl. 3, Fig. 41–46.
1979 *Lenticulina turgidula* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 42; Pl. 9, Fig. 7.
1982 *Lenticulina (L.) turgidula* (REUSS) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 644.

Occurrence. – Originally described from the northwestern German Albian; worldwide in the Aptian and Albian; Ukraine and Crimea Hauterivian and Aptian; Caucasus Aptian.

Lenticulina (L.) vocontiana MOULLADE 1966

Pl. 5, Fig. 7–9

1973 *Lenticulina (L.) vocontiana* MOULLADE – BARTENSTEIN & BOLLI, Trinidad *3*, 398; Pl. 3, Fig. 32–35.
1979 *Lenticulina vocontiana* MOULLADE – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 42; Pl. 10, Fig. 4.

Occurrence. – An excellent index for the Upper Aptian of southern France, for the *Planomalina maridalensis* Zone and the *Hedbergella rohri* Zone of Trinidad; present also in the Aptian of the Ukraine and the Crimea.

Lingulina loryi (BERTHELIN 1880)

Pl. 5, Fig. 15–16

1973 *Lingulina loryi* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *3*, 406; Pl. 5, Fig. 75.
1975 *Lingulina loryi* (BERTHELIN) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 99; Pl. 75, Fig. 9, 14–15, 21–25.
1982 *Frondicularia loryi* BERTHELIN – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 638; Pl. 2, Fig. 19–20.

Occurrence. – Lower Cretaceous worldwide; in Trinidad Barremian to Lower Albian, very rare.

Remarks. – *Lingulina praelonga* DAM 1946 from the Barremian in Trinidad, part 1, possibly belongs to the variability of *Lingulina loryi* (BERTHELIN). For more details see BARTENSTEIN & KOVATCHEVA (1982: 638–639).

Marginulina bullata REUSS 1845

Pl. 5, Fig. 17–18

1860 *M. bullata* REUSS – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *40*, 205; Pl. 6, Fig. 4–6.
1928 *M. bullata* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N.F.] *111*, 76; Pl. 7, Fig. 6–7.
1973 *Marginulina* cf. *M. bullata* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 54; Pl. 6, Fig. 7.

Occurrence. – Higher Upper Cretaceous of Central Europe and North America; higher Lower Cretaceous and Cenomanian of northern California, rare.

Remarks. – *Marginulina curvata* CUSHMAN 1938 from the Gulf Series in Texas may be closely related to *Marginulina bullata*. Visible coiling of the primordial three to four chambers indicates transitional stages to *Lenticulina (M.) cephalotes* (REUSS 1863).

Marginulina pyramidalis (KOCH 1851)

Pl. 5, Fig. 19–20

1973 *Marginulina pyramidalis* (KOCH) – BARTENSTEIN & BOLLI, Trinidad *3*, 403; Pl. 6, Fig. 5–8.
1973 *Marginulina pyramidalis* (KOCH) – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 54; Pl. 6, Fig. 10.

Occurrence. – Worldwide throughout the Lower and lower Upper Cretaceous; in Trinidad Barremian to Lower Albian, rare.

Remarks. – A large variation exists in the morphology of the tests, such as the location of the aperture. It may be central as in *Nodosaria obscura* or more marginal as in *Marginulina* and *Dentalina*. Ribs consist of either few relatively vigorous costae or numerous thin costae. The same applies to *Nodosaria obscura* and to some other costate species of the genera *Marginulina*, *Nodosaria* and *Dentalina*.

Nodosaria jonesi REUSS 1863

Pl. 5, Fig. 21–22

1863 *Nodosaria Jonesi* n.sp. – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *46*, 89; Pl. 12, Fig. 6.
1893 *Nodosaria radicula* LINNE var. *Jonesi* REUSS – CHAPMAN, J. r. microsc. Soc. *13*, 586; Pl. 8, Fig. 22.

Occurrence. – Originally described and later cited from Zone IX and XI of the Gault of Folkestone corresponding to the lower part of the Upper Albian with *Mortoniceras inflatum*; always very rare.

Nodosaria linearis ROEMER 1841

Pl. 5, Fig. 23–24

1957 *Dentalina linearis* (ROEMER) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1*, 35; Pl. 7, Fig. 148.
1973 *Dentalina linearis* (ROEMER) – BARTENSTEIN & BOLLI, Trinidad *3*, 405; Pl. 5, Fig. 59–60.

1979 *Dentalina linearis* (ROEMER) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 51; Pl. 13, Fig. 3.

Occurrence. – Lower Cretaceous worldwide; in Trinidad Barremian to Lower Albian, always very rare.

Remarks. – Most tests in the *Hedbergella rohri* Zone are true *Nodosaria,* with apertures in the center of the last formed chamber, similar to Plate 7, Figure 148 in Trinidad *1.* Our specimens are relatively undersized.

Nodosaria nuda REUSS 1863

1863 *N. nuda* m. – REUSS, Sitzber. kais. Akad. Wiss. (Wien), math.-natw. Cl. *46,* 38; Pl. 2, Fig. 8–9.
1975 *Nodosaria nuda* REUSS – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25,* 92; Pl. 72, Fig. 6–7, 9.

Occurrence. – First described from the lower part of the Middle Albian, *Minimus* Clay, in northwestern Germany; Lower Cretaceous and basal Upper Cretaceous, very rare.

Nodosaria obscura REUSS 1863

Pl. 5, Fig. 25–26

1957 *Nodosaria obscura* REUSS – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1,* 36; Pl. 5, Fig. 101; Pl. 6, Fig. 129.
1973 *Nodosaria obscura* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106,* 65; Pl. 9, Fig. 8.
1979 *Nodosaria obscura* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 27; Pl. 5, Fig. 10.
1982 *Nodosaria obscura* REUSS – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 645; Pl. 3, Fig. 23–24.

Occurrence. – In Texas Cenomanian to Campanian; in northern California entire Lower Cretaceous; in the Soviet Union Barremian to Albian; in Trinidad Barremian to Lower Albian, rare.

Remarks. – On the development of ribs and the position of the aperture, see remarks on *Marginulina pyramidalis.*

Nodosaria orthopleura REUSS 1863

Pl. 5, Fig. 27–29

1966 *Nodosaria orthopleura* REUSS – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2,* 152; Pl. 3, Fig. 230.
1979 *Nodosaria orthopleura* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 27; Pl. 5, Fig. 29.
1984 *Nodosaria orthopleura* REUSS – MOULLADE, Benthos *83,* 446; Pl. 2, Fig. 9.

Occurrence. – Originally described from the Middle to Upper Albian Gault of Folkestone; Albian in the Soviet Union.

Remarks. – Specimens with 5 ribs are very rare, tests with 6 ribs are normal.

Nodosaria paupercula REUSS 1845

Pl. 5, Fig. 30–31

1957 *Nodosaria paupercula* REUSS – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *1,* 36; Pl. 7, Fig. 151.

1973 *Nodosaria paupercula* REUSS – DAILEY, Publ. geol. Sci. Univ. Calif. *106,* 66; Pl. 9, Fig. 9.
1979 *Nodosaria paupercula* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 27; Pl. 5, Fig. 14.

Occurrence. – Higher Lower Cretaceous and Upper Cretaceous worldwide; in Texas and northern California known from Barremian to basal Cenomanian; European part of the Soviet Union Berriasian to Hauterivian; in Trinidad Barremian to Lower Albian, rare.

Remarks. – The position of the aperture can be central as in *Nodosaria* or more marginal as in *Dentalina.*

Nodosaria sceptrum REUSS 1863

Pl. 5, Fig. 32–34

1977 *Nodosaria sceptrum* REUSS – BARTENSTEIN & BOLLI, Trinidad *4,* 553; Pl. 2, Fig. 13.
1979 *Nodosaria sceptrum* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 28; Pl. 5, Fig. 17.

Occurrence. – Lower Cretaceous worldwide; in Trinidad Barremian to Lower Albian, rare.

Remarks. – Transitional forms are common between *N. sceptrum, N. tubifera* REUSS 1863, *N. bactroides* REUSS 1863 and *N. lamelloso-costata* REUSS 1863, which are all known from the same localities in northwestern Germany.

Orthokarstenia shastaensis DAILEY 1970

Pl. 5, Fig. 35

1965 *Siphogenerina asperula* (CHAPMAN) – NEAGU, Micropaleontology *11*/1, 29; Pl. 7, Fig. 16.
1977 *Orthokarstenia shastaensis* DAILEY – BARTENSTEIN & BOLLI, Trinidad *4,* 554; Pl. 2, Fig. 18–19.
1984 *Orthokarstenia shastaensis* DAILEY – MOULLADE, Benthos *83,* 450; Pl. 4, Fig. 3–4; Textfig. 4.

Occurrence. – Uppermost Barremian to Cenomanian in the western hemisphere (California, Trinidad, Grand Banks and Blake Plateau). In the *Hedbergella rohri* Zone of Trinidad one specimen only was recorded.

Remarks. – Occurrences in the eastern hemisphere are in most cases named *Siphogenerina asperula* (CHAPMAN 1896): see BARTENSTEIN & BOLLI (1977: 555). *Siphogenerina asperula* has the same stratigraphic range as *Orthokarstenia shastaensis,* beginning in the uppermost Barremian, and common in the Albian.

Pseudonodosaria humilis (ROEMER 1841)

Pl. 5, Fig. 36–37

1973 *Rectoglandulina humilis* (ROEMER) – BARTENSTEIN & BOLLI, Trinidad *3,* 406; Pl. 6, Fig. 9–12.
1979 *Pseudonodosaria humilis* (ROEMER) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 31; Pl. 6, Fig. 8.
1984 *Pseudonodosaria humilis* (ROEMER) – MOULLADE, Benthos *83,* 446; Pl. 2, Fig. 12.

Occurrence. – Entire Lower Cretaceous worldwide in the boreal and tethyan realms; in Trinidad Barremian to Lower Albian, rare to infrequent.

Remarks. – A close relationship exists to *P. tenuis* (BORNEMANN 1854) and *P. mutabilis* (REUSS 1863): see BARTENSTEIN & BRAND (1951: 315–316) and DAILEY (1973: 66).

Pseudonodosaria mutabilis (REUSS 1863)

Pl. 6, Fig. 1–3

1973 *Rectoglandulina mutabilis* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 405.
1979 *Pseudonodosaria mutabilis* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 31; Pl. 6, Fig. 11.
1982 *Pseudonodosaria mutabilis* (REUSS) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 646; Pl. 3, Fig. 26.

Occurrence. – The species has the same distribution as *P. humilis*, locally persisting to the Cenomanian; in Trinidad also Barremian to Lower Albian, rare to infrequent.
Remarks. – A close relationship exists to *P. tenuis* (BORNEMANN 1854) and *P. humilis*.

Tristix acutangula (REUSS 1863)

Pl. 5, Fig. 38

1973 *Tristix acutangula* (REUSS) – BARTENSTEIN & BOLLI, Trinidad *3*, 406; Pl. 6, Fig. 3–4.
1982 *Tristix acutangula* (REUSS) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 646; Pl. 3, Fig. 29–30.

Occurrence. – Worldwide throughout the Lower Cretaceous, rare. In Trinidad Barremian to Lower Albian, infrequent.

Tristix globulifera (REUSS 1860)

Pl. 5, Fig. 39–41

1928 *Rhabdogonium globuliferum* REUSS – FRANKE, Abh. preuss. geol. Landesanst. [N.F.] *111*, 73; Pl. 6, Fig. 21.
1979 *Tristix globuliferum* (REUSS) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 29; Pl. 6, Fig. 4.

Occurrence. – Rare but characteristic in the Albian and Upper Cretaceous.
Remarks. – This species is probably a juvenile form of *Tristix* (REUSS 1860, p. 201; FRANKE 1928, p. 73) or of *Lenticulina* (REUSS 1863). Another possibility is that the two chambers represent the initial part of a *Lenticulina* species, for example *Lenticulina (M.) cephalotes* (REUSS 1863). – Local occurrences of such "juvenile" stages are typical in the northwestern German Albian and higher Upper Cretaceous.

Vaginulina arguta REUSS 1860

Pl. 6, Fig. 4–6

1977 *Vaginulina arguta* REUSS – BARTENSTEIN & BOLLI, Trinidad *4*, 553; Pl. 2, Fig. 14.
1979 *Vaginulina arguta* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 52; Pl. 13, Fig. 7.
1982 *Vaginulina arguta* REUSS – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 647; Pl. 4, Fig. 1–2.

Occurrence. – Entire Lower Cretaceous, persisting to the Cenomanian, worldwide; Barremian to Albian in the European part of the Soviet Union; same in Trinidad, rare.

Remarks. – The four species *V. transversalis* REUSS 1860, *V. eurynota* REUSS 1863, *V. protosphaera* REUSS 1983 and *V. truncata* REUSS 1863 are synonymous to *V. arguta* REUSS 1860.

Vaginulina geisendoerferi FRANKE 1928

Pl. 6, Fig. 9

1954 *Citharina geisendoerferi* FRANKE – FRIZZELL, Rep. Invest. Bur. econ. Geol. Univ. Texas *22*, 94; Pl. 11, Fig. 5.
1973 *Vaginulina riedeli* BARTENSTEIN & BRAND – DAILEY, Publ. geol. Sci. Univ. Calif. *106*, 58; Pl. 7, Fig. 12 [non *Vaginulina riedeli*].
1975 *Vaginulina riedeli riedeli* BARTENSTEIN & BRAND – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 85; Pl. 64, Fig. 28–29 [non *Vaginulina riedeli riedeli*].

Occurrence. – Aptian, Albian and deeper Upper Cretaceous, rare, but characteristic in its shape.

Remarks. – The only specimen found shows indications of single fine carina diagonally across the lateral side and along the septal face.

Vaginulina recta REUSS 1863

Pl. 6, Fig. 7–8

1977 *Vaginulina recta* REUSS – BARTENSTEIN & BOLLI, Trinidad *4*, 553; Pl. 2, Fig. 15–16.
1979 *Vaginulina recta* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 53; Pl. 13, Fig. 10.
1984 *Lenticulina (Vaginulina) recta* (REUSS) – MOULLADE, Benthos *83*, 448; Pl. 3, Fig. 16.
1984 *"Citharina" recta* group – MAGNIEZ & SIGAL, Init. Rep. Deep Sea Drill. Proj. *80*, 611; Fig. 2.

Occurrence. – Originally described from the Middle Albian, *Minimus* Clay, in northwestern Germany, the species occurs worldwide in the Lower and Upper Cretaceous; Neocomian to Albian in the European part of the Soviet Union; Barremian to Lower Albian in Trinidad, rare.

Vaginulina striolata REUSS 1863

Pl. 6, Fig. 10

1975 *Vaginulina gaultina* BERTHELIN – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 85; Pl. 64, Fig. 26.
1979 *Vaginulina gaultina* BERTHELIN – BARTENSTEIN, Newsl. Stratigr. *7*/3, 150; Table 2.

Occurrence. – Entire Lower Createceous, but typical only in the Albian, very rare.

Remarks. – The three species *V. strombecki* REUSS 1863, *V. comitina* BERTHELIN 1880 and *V. gaultina* BERTHELIN 1880 are synonymous to *V. striolata* REUSS 1863.

Family Polymorphinidae

Bullopora laevis (SOLLAS 1877)

Pl. 3, Fig. 16–17

1951 *Bullopora laevis* (SOLLAS) – BARTENSTEIN & BRAND, Abh. senckenb. natf. Ges. *485*, 321; Pl. 11, Fig. 300–304.
1954 *Vitriwebbina laevis* (SOLLAS) – FRIZZELL, Rep. Invest. Bur. econ. Geol. Univ. Texas *22*, 107; Pl. 15, Fig. 5.
1975 *Bullopora laevis* (SOLLAS) – NEAGU, Mem. Inst. Geol. Geophys. (Bucarest) *25*, 103; Pl. 78, Fig. 9–10, 12.

Occurrence. – Jurassic to Tertiary, mostly rare and only preserved as fragments; an attached species. Known in the Aptian, Albian and Lower Cenomanian of Texas.

Remarks. – We follow NEAGU 1975 and place *Bullopora* in the family Polymorphinidae.

Falsoguttulina vandenboldi (BARTENSTEIN, BETTENSTAEDT & BOLLI 1957)

Pl. 3, Fig. 18–19

1966 *Falsoguttulina vandenboldi* (BARTENSTEIN, BETTENSTAEDT & BOLLI) – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 158; Pl. 3, Fig. 309–314.

1973 *Falsoguttulina vandenboldi* (BARTENSTEIN, BETTENSTAEDT & BOLLI) – BARTENSTEIN & BOLLI, Trinidad *3*, 407.

Occurrence. – Barremian to Lower Albian of Trinidad; Albian of northern California, rare.

Remarks. – At the time of the description of *Falsoguttulina* BARTENSTEIN & BRAND 1949 n. gen. in the Valanginian of northwestern Germany, this genus was monotypic with *Falsoguttulina wolburgi* BARTENSTEIN & BRAND. The presence of *Falsoguttulina vandenboldi* in the Lower Cretaceous of Trinidad proves the worldwide distribution of this genus in various facies realms of the Lower Cretaceous.

A conspicuous convergence exists between the genus *Falsoguttulina* BARTENSTEIN & BRAND 1949 with a calcareous wall and a slit-like, partially curved aperture, belonging to the familiy Polymorphinidae, and the genus *Falsogaudryinella* BARTENSTEIN 1977 with a finely agglutinated wall and the same type of aperture, showing as an elliptical orifice or slit, assigned to the family Verneuilinidae. Both occur worldwide in the Lower Cretaceous from Berriasian to Albian. When the wall becomes corroded or diagenetically modified due to calcification or pseudo-agglutination, it may become difficult or impossible to place such specimens into one of the two genera.

In Trinidad specimens of the genera *Globulina, Guttulina* and *Pyrulina* are in general strongly corroded and as a result often very poorly preserved. The distinction of the various species is therefore often difficult.

Globulina prisca REUSS 1863

Pl. 3, Fig. 20–22

1977 *Globulina prisca* REUSS – BARTENSTEIN & BOLLI, Trinidad *4*, 555; Pl. 2, Fig. 20–22.

1979 *Globulina prisca* REUSS – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 55; Pl. 13, Fig. 18.

Occurrence. – Worldwide in the Cretaceous.

Guttulina aff. *symploca* LOEBLICH & TAPPAN

Pl. 3, Fig. 23

1954 *Guttulina symploca* LOEBLICH & TAPPAN – FRIZZELL, Rep. Invest. Bur. econ. Geol. Univ. Texas *22*, 104; Pl. 14, Fig. 18.

Occurrence. – Glen Rose Limestone and Walnut Clay of Texas, corresponding to Upper Aptian to Middle Albian in Europe.

Remarks. – Only fragments are present in the *Hedbergella rohri* Zone.

Pyrulina cylindroides (ROEMER 1838)

Pl. 3, Fig. 24–25

1973 *Pyrulina cylindroides* (ROEMER) – BARTENSTEIN & BOLLI, Trinidad *3*, 407; Pl. 6, Fig. 13–17.

Occurrence. – Originally described from the northwestern German Tertiary, the species also occurs in the Cretaceous worldwide.

Pyrulina exserta (BERTHELIN 1880)

Pl. 3, Fig. 26–28

1973 *Pyrulina exserta* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *3*, 407.
1979 *Globulina exserta* (BERTHELIN) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 55; Pl. 13, Fig. 19.

Occurrence. – Worldwide in the Lower Cretaceous; Upper Albian in the Soviet Union.

Remarks. – For the details about BERTHELIN'S type material see: Revision von BERTHELIN'S Mémoire 1880 über die Alb-Foraminiferen von Montcley by H. BARTENSTEIN 1954, Senckenb. Lethaea *35*/1–2, p. 47.

Ramulina aculeata WRIGHT 1863

Pl. 3, Fig. 29–33

1966 *Ramulina aculeata* WRIGHT – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 159; Pl. 4, Fig. 315–336.
1979 *Ramulina spinata* ANTONOVA – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 57; Pl. 14, Fig. 5.
1984 *Ramulina aculeata* WRIGHT [non D'ORBIGNY]-MOULLADE, Benthos *83*, 448; Pl. 3, Fig. 19.

Occurrence. – Worldwide in the Mesozoic and Cenozoic; in Trinidad Barremian to Upper Cretaceous, infrequent.

Remarks. – Concerning the variability of the tests, see Trinidad *2*, 159–161. It is very doubtful if many forms identified as *Ramulina aculeata*, or *R. laevis* JONES 1875 and *R. globulifera* H. B. BRADY 1879, really belong to these species.

Ramulina berthelini BARTENSTEIN & BOLLI 1973

Pl. 3, Fig. 38

1973 *Ramulina berthelini* n. sp. – BARTENSTEIN & BOLLI, Trinidad *3*, 408; Pl. 6, Fig. 36–40.
1985 *Ramulina berthelini* BARTENSTEIN & BOLLI – BARTENSTEIN, Newsl. Stratigr. *14*/2, 111; Pl. 1, Fig. 13–15.

Occurrence. – In Texas, northwestern Germany and Rumania Upper Aptian to basal Upper Albian (BARTENSTEIN & BOLLI 1973, p. 409); in Trinidad Upper Aptian to Lower Albian (Trinidad *2, 3, 5*).

Ramulina globulifera H. B. BRADY

Pl. 3, Fig. 34–37

1966 *Ramulina globulifera* BRADY – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 159.

Occurrence. – Worldwide in the Mesozoic and Cenozoic; in Trinidad from Barremian to Lower Albian, rare.

Ramulina grandis (FUCHS 1967)

Pl. 3, Fig. 39–40

1938 *Thurammina* D1 – HECHT, Abh. senckenb. natf. Ges. *443*, Pl. 24, Fig. 118.
1950 *Ramulina globotubulosa* CUSHMAN – DAM, Mém. Soc. géol. France [n.s.] *19*/4: Pl. 4, Fig. 1 (non *globo-tubulosa* CUSHMAN).
1967 *Cornusphaera grandis* n. gen. n. sp. – FUCHS, J. geol. Bundesanst. *110*, 321; Pl. 16, Fig. 2–3.
1973 *Ramulina*? sp. [*Ramulina grandis* (FUCHS)] – BARTENSTEIN & BOLLI, Trinidad *3*, 407.
1975 *Ramulina* sp. – LUTERBACHER, Init. Rep. Deep Sea Drill. Proj. *32*, Pl. 3, Fig. 6.
1977 *Ramulina aculeata* WRIGHT – BARTENSTEIN & BOLLI, Trinidad *4*, 555; Pl. 2, Fig. 23.

Occurrence. Upper Aptian in the northwestern Pacific; higher Middle Albian in northwestern Germany; Upper Albian and Cenomanian in Texas.

Remarks. – Typical, practically spherical, calcareous tests with coarse tubes resemble the above cited figures and occur worldwide in the late Lower Createaceous. The species appears closely related to *Ramulina aculeata* WRIGHT.

Ramulina laevis JONES 1875

1966 *Ramulina laevis* JONES – BARTENSTEIN, BETTENSTAEDT & BOLLI, Trinidad *2*, 159; Pl. 3, Fig. 295–296.
1984 *Ramulina laevis* JONES – MOULLADE, Benthos *83*, 448; Pl. 3, Fig. 20.

Occurrence. – Worldwide in the Mesozoic and Cenozoic; in Trinidad Upper Barremian to Lower Albian, rare.

Superfamily Rotaliidea

Conorotalites aptiensis (BETTENSTAEDT 1952)

Pl. 6, Fig. 11–13

1977 *Conorotalites aptiensis* (BETTENSTAEDT) – BARTENSTEIN & BOLLI, Trinidad *4*, 558; Pl. 3, Fig. 6–10.
1979 *Conorotalites bartensteini intercedens* BETTENSTAEDT – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 61; Pl. 16, Fig. 1 (pars).
1982 *Conorotalites aptiensis* (BETTENSTAEDT) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 647; Pl. 4, Fig. 5.

Occurrence. – Originally described from northwestern Germany, the species extends from uppermost Barremian to basal Lower Albian in microfaunal terminology or to higher Upper Aptian in Ammonite terminology. The stratigraphic range appears to be the same in Trinidad.

The species is a useful worldwide index foraminifer. In the Aptian of the Ukraine and the European part of the Soviet Union, *Conorotalites aptiensis* may fall into the variability range of *Conorotalites bartensteini intercedens*.

Remarks. – The application of the phylogenetic development of *Conorotalites bartensteini* and its subspecies *bartensteini, intercedens* and *aptiensis* allows a detailed subdivision of the Barremian through Albian in Trinidad with *C. intercedens* (Trinidad *1*, 48) and *C. aptiensis* (Trinidad *2–5*). Only the earliest known form, *C. bartensteini* of the Lower and lower Middle Barremian, has so far not been recorded from Trinidad.

Globorotalites sp., aff. *aptiensis* BETTENSTAEDT 1952, described by MOULLADE (1966, p. 68; Pl. 7, Fig. 1–4) from the Upper Albian, Vraconian, to Cenomanian of southern France, resembles *Globorotalites brotzeni* HOFKER (1957, p. 403; Fig. 455) from the Upper Albian of Holland. We admit the possibility of a persistence of the true *Conorotalites aptiensis* to the Cenomanian.

Conorotalites intercedens reported by GRADSTEIN (1978, p. 668; Textfig. 4) in the Late Albian of DSDP Hole 392A, Black Nose, possibly belongs to the above mentioned forms.

Gavelinella intermedia (BERTHELIN 1880)

Pl. 6, Fig. 14–22

1977 *Gavelinella intermedia* (BERTHELIN) – BARTENSTEIN & BOLLI, Trinidad *4*, 558; Pl. 3, Fig. 4–5.
1982 *Gavelinella intermedia* (BERTHELIN) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 649; Pl. 4, Fig. 20–21.
1985 *Gavelinella intermedia* (BERTHELIN) – BARTENSTEIN, Newsl. Stratigr. *14*/2, 114; Pl. 2, Fig. 28–30.

Occurrence. – Worldwide from Lower Aptian to Upper Albian in the temperate and tethyan realms; persisting to the Cenomanian as an index foraminifer. – Ukraine, Crimea and Caucasus Upper Aptian and Albian; Trinidad uppermost Barremian(?), Lower Aptian to Lower Albian.

Remarks. – The species has developed from *Gavelinella barremiana* in the uppermost Barremian. During the Lower to Middle Albian, *Gavelinopsis berthelini* (KELLER 1935) develops from *Gavelinella intermedia* and flourishes in the high Middle and Upper Albian. Because we have no proof of *Gavelinopsis berthelini* until now in the *Hedbergella rohri* Zone, we believe in its pre-Middle Albian age. The same applies to the true *Gavelinella ammonoides* (REUSS 1845); non *Gavelinella* cf. *ammonoides* in Trinidad *3*, 410; develops near the boundary Middle/Upper Albian and flourishes in the Cenomanian and Turonian. – Concerning the variability and development of *Gavelinella intermedia*, see MICHAEL 1966, Senckenb. Lethaea *47*, 432.

Valvulineria loetterlei (TAPPAN 1940)

Pl. 6, Fig. 23–26

1977 *Valvulineria loetterlei* (TAPPAN) – BARTENSTEIN & BOLLI, Trinidad *4*, 556; Pl. 2, Fig. 30–33.
1982 *Valvulineria loetterlei* (TAPPAN) – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 651; Pl. 4, Fig. 35–36; Pl. 5, Fig. 45–46.
1984 *Valvulineria parva* KHAN – MAGNIEZ & SIGAL, Init. Rep. Deep Sea Drill. Proj. *80*, 603; Pl. 4, Fig. 17.
1984 *Valvulineria gracillima* TEN DAM – MAGNIEZ & SIGAL, Init. Rep. Deep Sea Drill. Proj. *80*, 603; Pl. 4, Fig. 18–19.

Occurrence. – Worldwide from Barremian to Turonian in the tethyan and temperate realms; Aptian and Lower Albian in the European part of the Soviet Union; Barremian to Lower Albian in Trinidad, common.

Remarks. – A distinct difference exists between tests of normal growth and small, possibly juvenile tests. The latter are mostly called *Valvulineria gracillima* DAM 1947 which is synonymous with *V. loetterlei* (see Trinidad *3*, 410). The same applies to other *Valvulineria* species, possibly also to *Gyroidinoides* species of the Aptian and Albian, e.g. *Valvulineria parva* KHAN 1950 or *Gyroidinoides infracretacea* MOROZOVA 1948.

Superfamily Spirillinidea

Patellina subcretacea CUSHMAN & ALEXANDER 1930

1977 *Patellina subcretacea* CUSHMAN & ALEXANDER – BARTENSTEIN & BOLLI, Trinidad *4,* 556; Pl. 2, Fig. 29.
1979 *Patellina subcretacea* CUSHMAN & ALEXANDER – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 84; Pl. 23, Fig. 8.
1982 *Patellina subcretacea* CUSHMAN & ALEXANDER – BARTENSTEIN & KOVATCHEVA, Eclogae geol. Helv. *75*/3, 652; Pl. 4, Fig. 37.

Occurrence. – Throughout the Lower Cretaceous worldwide in the temperate and tethyan realms; in the Soviet Union Barremian to Aptian; in Trinidad Barremian to Lower Albian.

Remarks. – In our material only represented as fragments.

Spirillina minima SCHACKO 1892

Pl. 6, Fig. 27–28

1977 *Spirillina minima* SCHACKO – BARTENSTEIN & BOLLI, Trinidad *4,* 556; Pl. 2, Fig. 24–28.
1979 *Spirillina minima* SCHACKO – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 81; Pl. 22, Fig. 11.
1982 *Spirillina minima* SCHACKO – BARTENSTEIN & KOVATECHEVA, Eclogae geol. Helv. *75*/3, 652; Pl. 4, Fig. 38–39; Pl. 54, Fig. 43–44.

Occurrence. – Throughout the Cretaceous worldwide in the temperate and tethyan realms, rare; Berriasian to Aptian in the Soviet Union; Barremian to Lower Albian in Trinidad.

STRATIGRAPHICALLY SIGNIFICANT BENTHIC INDEX FORAMINIFERA ABSENT IN THE HEDBERGELLA ROHRI ZONE OF TRINIDAD

A. Mainly occurring below the *Hedbergella rohri* Zone

Marssonella praeoxycona (MOULLADE 1966)

BARTENSTEIN & BOLLI 1977, Trinidad *4,* 548; Pl. 1, Fig. 25–26; Textfig. 2. – BARTENSTEIN & KOVATCHEVA 1982, Eclogae geol. Helv. *75*/3, 631, Pl. 1, Fig. 20–21; Pl. 5, Fig. 16.

Predominant occurrence. – Barremian to Middle (and Upper?) Aptian according to the European ammonite terminology.

Genus *Citharina* ORBIGNY 1839

KROBOTH 1966, unveröff. Diss. math.-natw. Fak. Univ. (Tübingen): 1–63.

Predominant occurrence. – Berriasian to Lower Albian according to the European microfaunal terminology.

Lenticulina (*A.*) *crepidularis* (ROEMER 1842) and *L.* (*A.*) *tricarinella* (REUSS 1863)

BARTENSTEIN & BOLLI 1977, Trinidad *4,* 551; Pl. 2, Fig. 3–4; Textfig. 2.

Predominant occurrence. – Upper Middle Jurassic (Dogger) to Lower Aptian.

Lenticulina (A.) maridalensis (BARTENSTEIN & BOLLI 1973)

BARTENSTEIN & BOLLI 1977, Trinidad *4,* 552; Pl. 2, Fig. 6–8.
Occurrence. – *Leupoldina protuberans* and *Planomalina maridalensis* zones of Trinidad.

Lenticulina (L.) nodosa (REUSS 1863)

BARTENSTEIN & KOVATCHEVA 1982, Eclogae geol. Helv. *75*/3, 642; Pl. 3, Fig. 6–7.
Predominant occurrence. – Tethyan Realm Kimmeridgian to Upper Aptian and, locally, Cenomanian; Boreal Realm Berriasian to Lower Hauterivian.

Lenticulina (L.) ouachensis (SIGAL 1952)

BARTENSTEIN & BOLLI 1977, Trinidad *4,* 550, Pl. 1, Fig. 37; Pl. 2, Fig. 1–2; Textfig. 2.
Predominant occurrence. – Middle Valanginian to Lower Aptian worldwide, in Trinidad Middle Barremian to lower Upper Aptian.

Lenticulina (S.) spinosa (EICHENBERG 1935)

BARTENSTEIN & KOVATCHEVA 1982, Eclogae geol. Helv. *75*/3, 644; Pl. 3, Fig. 20–21.
Predominant occurrence. – Middle Lower Aptian, *deshayesi* Zone, to higher Upper Aptian, *nolani* Zone, according to the European ammonite terminology.

Lenticulina (L.) strombecki (REUSS 1863)

BARTENSTEIN & BOLLI 1973, Trinidad *3,* 400.
Occurrence. – Upper Aptian in Trinidad according to the European ammonite terminology.

B. Occurring throughout the Lower Cretaceous but not recorded from the *Hedbergella rohri* Zone

Tritaxia tricarinata (REUSS 1843) and *T. pyramidata* REUSS 1863

FRIEG 1980, Paläont. Z. *54*/3–4, 234; Fig. 3.
Predominant occurrence. – Tethyan Realm Upper Valanginian to Albian; Boreal Realm Upper Aptian to Upper Cretaceous.

Genus *Epistomina* TERQUEM 1883

Predominant occurrence. – A worldwide known genus ranging from Jurassic to Recent, with important index species in the Aptian and Albian. It is assumed that the absence in the *Hedbergella rohri* Zone of representatives of this significant genus is for environmental reasons.

C. Mainly occurring above the *Hedbergella rohri* Zone

Genus *Arenobulimina* CUSHMAN 1927

FRIEG & PRICE 1982, Asp. Micropaleont. (London) *2*, 42–77.
Predominant occurrence. – Middle Albian to Upper Cretaceous.

Spiroplectinata annectens (PARKER & JONES 1863)

GRABERT 1959, Abh. senckenb. natf. Ges. *498*, 12; Pl. 1, Fig. 10–12; Pl. 2, Fig. 36–38; Pl. 3, Fig. 77–86.
Predominant occurrence. – Middle Albian to Cenomanian.

Genus *Pleurostomella* REUSS 1860

BETTENSTAEDT & SPIEGLER 1982, Geol. Jb. [Reihe A 65]: 445–479.
Predominant occurrence. – Middle Albian to Cenomanian.

Genus *Pseudosigmoilina* BARTENSTEIN 1965

HART 1973, Geol. J. (Liverpool), spec. Issue *5*, 278; Fig. 3 *(Q. antiqua)*.
Predominant occurrence. – Higher Middle Albian and Upper Albian.
The above listed genera and species absent in the *Hedbergella rohri* Zone assemblage are known to occur mainly either below or above the assumed Late Aptian to earliest Albian age for the zone. Their absence therefore provides further support for such a zonal age. Unfavourable environmental conditions may explain the absence of the widespread and long ranging *Tritaxia tricarinata* and the genus *Epistomina* in the examined fauna.

PLANKTIC FORAMINIFERA

Superfamily Globigerinacea

The planktic foraminifera form only a small portion of the total fauna of the *Hedbergella rohri* Zone compared with the benthic forms. The two most significant taxa present in the zone were previously described and illustrated in BOLLI (1959) under the names *Planomalina* cf. *apsidostroba* LOEBLICH & TAPPAN (here included in *Planomalina cheniourensis*) and *Praeglobotruncana rohri* BOLLI (here placed in the genus *Hedbergella)*. Both species were shown to be restricted to the *Hedbergella rohri* Zone.

Other species shown by BOLLI (1959) to occur but not to be restricted to the *Hedbergella rohri* Zone were *Praeglobotruncana infracretacea* and *P. gautierensis*. Specimens that were placed into these species are here included in *Hedbergella delrioensis*. Apparently restricted to the *Hedbergella rohri* Zone but not described previously from Trinidad is *Globigerinelloides*? *gyroidinaeformis* MOULLADE, a planispiral involute form that is included here in the Globigerinacea, though with some reservation. Very rare specimens, not previously recorded in BOLLI (1959), are figured and briefly described here as *Globigerinelloides ferreolensis* and forms regarded as close to *G. blowi*.

Globigerinelloides cf. *blowi* (Bolli 1959)

Pl. 6, Fig. 30

1959 *Planomalina blowi* Bolli n. sp. – Bolli, Bull. amer. Paleont. *34*/179, 260; Pl. 20, Fig. 2–3.
1966 *Globigerinelloides blowi* (Bolli) – Moullade, Doc. Lab. Géol. Fac. Sci. Lyon *15*, 119; Pl. 8, Fig. 24–26.
1979 *Blowiella blowi* (Bolli) – Kaptarenko-Chernousova, Plotnikova & Lipnik, Inst. Geol. NAUK (Kiev) 73; Pl. 20, Fig. 10.

Occurrence. – In Trinidad restricted to the *Hedbergella rohri* Zone.

Remarks. – The very rare *Globigerinelloides* specimens that occur in the *Hedbergella rohri* Zone are closest to *G. blowi* which however in Trinidad appears to be confined to the Lower Aptian *Leupoldina protuberans* Zone (Bolli 1959). The *Globigerinelloides* specimen from the *Hedbergella rohri* Zone differs from the typical *G. blowi* in that the chambers forming the last whorl are more globular and increase more rapidly in size as added which in turn results in a more distinctly lobate equatorial periphery.

Globigerinelloides ferreolensis (Moullade 1961)

Pl. 6, Fig. 31

1961 *Biticinella ferreolensis* n. sp. – Moullade, Rev. Micropal. *3*/4, 214; Pl. 1, Fig. 1–5.
1979 *Globigerinelloides ferreolensis* (Moullade) – Kaptarenko-Chernousova, Plotnikova & Lipnik, Inst. Geol. NAUK (Kiev) *72*; Pl. 19, Fig. 11.
1984 *Globigerinelloides* cf. *ferreolensis* (Moullade) – Magniez & Sigal, Init. Rep. Deep Sea Drill. Proj. *80*, 625; Pl. 6, Fig. 20.

Occurrence. – The range given by Caron (1985) for *G. ferreolensis* is Middle to Late Aptian. Magniez & Sigal (1984) illustrate their "cf" form from the Middle Albian.

Remarks. – A single, poorly preserved specimen with 8 chambers in the last whorl has so far been found in the material from the *Hedbergella rohri* Zone. It seems to compare quite well with the rather open coiled holotype of *Globigerinelloides ferreolensis* re-illustrated in Caron (1985).

Globigerinelloides ? *gyroidinaeformis* Moullade 1966

Pl. 6, Fig. 32–34

1966 *"Globigerinelloides" gyroidinaeformis* n.sp. – Moullade, Doc. Lab. Géol. Fac. Sci. Lyon *15*, 128; Pl. 9, Fig. 16–22.

Occurrence. – Lower Albian and lower Middle Albian of southern France.

Remarks. – The specimens present in the *Hedbergella rohri* Zone compare well with the illustrations of the species originally described by Moullade from the Early Albian of southern France. He discusses the possible generic position of this characteristic involute, planispiral form whose 4 or occasionally 5 chambers of the last whorl are distinctly inflated. Though he does not exclude the possibility of a benthic nature and he places it with some reservation in the genus *Globigerinelloides*.

Hedbergella delrioensis (Carsey 1926)

Pl. 6, Fig. 46–48

1966 *Hedbergella delrioensis* (Carsey) – Bartenstein, Bettenstaedt & Bolli, Trinidad *2*, 164; Pl. 4, Fig. 360–370.

1966 *Hedbergella delrioensis* (Carsey) – Moullade, Doc. Lab. Géol. Fac. Sci. Lyon *15*, 94; Pl. 8, Fig. 17.
1973 *Hedbergella delrioensis* (Carsey) – Bartenstein & Bolli, Trinidad *3*, 412.
1974 *Hedbergella delrioensis* (Carsey) – Longoria, Rev. españ. Micropaleont., num. extraord. 54, Pl. 10, Fig. 1–3 (Neotype).

Remarks. – Along with the low trochospiral, tightly coiled zonal marker *Hedbergella rohri* with characteristically 7–9, more seldom 6 (holotype 9) chambers forming the last whorl occur other low spired but more loosely coiled specimens with only 5 to 5½ chambers. Such forms, which are frequent in the Early Cretaceous and, because of their similarities are often not easily distinguished have been described under a number of different species names. These include *Hedbergella delrioensis, H. gorbachikae* and *H. infracretacea* with 5 chambers, and the 6-chambered *H. planispira*. Quite extended ranges are given for these taxa within the Early Cretaceous, with some also extending into the Late Cretaceous. At the present time they are therefore regarded as being of little stratigraphic significance.

Of the above listed species the specimens from the *Hedbergella rohri* Zone of Trinidad, present also in the *Planomalina maridalensis* Zone of the Maridale Formation (Bartenstein, Bettenstaedt & Bolli 1966; Bartenstein & Bolli 1973), compare best with *Hedbergella delrioensis* whose holotype is characterized by strongly inflated chambers and by a distinctly lobate equatorial periphery in comparison with the more compact *Hedbergella rohri*.

Hedbergella rohri (Bolli 1959)

Pl. 6, Fig. 35–39, 43–45

1959 *Praeglobotruncana rohri* Bolli n. sp. – Bolli, Bull. amer. Paleont. *39*/179, 267; Pl. 22, Fig. 5–7.

Occurrence. – In Trinidad restricted to the *Hedbergella rohri* Zone.

Remarks. – *Hedbergella rohri* was originally described and figured by Bolli (1959) under the generic name *Praeglobotruncana* but is now placed in the genus *Hedbergella* which differs from *Praeglobotruncana* in the absence of a peripheral keel. Caron (1985) places *Hedbergella rohri* into synonymy with *H. trocoidea* (Gandolfi). The holotype of *H. trocoidea* and an additional specimen figured by Caron (Fig. 29/17, 18) possess only 7 chambers in the last whorl and – as the name implies – display a slightly trochoid spiral side. In contrast, typical *H. rohri* specimens are slightly more tightly coiled and have 8–9½ chambers in the last whorl (Bolli 1959, Pl. 22, Fig. 5–7).

The stratigraphic range given for *H. trocoidea* is Late Aptian to basal Albian which is closely comparable to that of *H. rohri*. Though the two taxa appear closely related both morphologically and in their stratigraphic position, they are kept apart for the differences pointed out above.

Planomalina cheniourensis (Sigal 1952)

Pl. 6, Fig. 40–42

1952 *Planulina cheniourensis* n. sp. – Sigal, Congr. géol. int. 19, Monogr. rég., 1.sér., *26*, 21; Fig. 17.
1966 *Planomalina cheniourensis* (Sigal) – Moullade, Doc. Lab. Géol. Fac. Sci. Lyon *15*, 130; Textfig. 3.
1979 *Planomalina cheniourensis* (Sigal) – Sigal, Init. Rep. Deep Sea Drill. Proj. *47*/2, 320; Pl. 3, Fig. 13.
1979 *Planomalina cheniourensis* (Sigal) – Kaptarenko-Chernousova, Plotnikova & Lipnik, Inst. Geol. NAUK (Kiev) 71, Pl. 20, Fig. 3.

Occurrence. – Algeria and southern France Middle and Upper Aptian; Leg 47B, Site 398, 200 km west of Oporto, Upper Aptian; Crimea and European part of the Soviet Union, Upper Aptian.

Remarks. – The specimens from the *Hedbergella rohri* Zone were originally placed by BOLLI (1959) into *Planomalina* cf. *apsidostroba.* The reasons for a "cf" assignment were based on the sutures of the Trinidad specimens not being limbate and being curved forward to a lesser degree than in the type specimen. *P. apsidostroba* is today generally regarded as a synonym of *P. buxtorfi* from which *P. cheniourensis* differs in its more numerous chambers forming the last whorl and in the absence of a peripheral keel in the last 3–4 chambers.

MOULLADE (1966) had already pointed out that the forms from Trinidad placed by BOLLI (1959) into *P.* cf. *apsidostroba* belong to *P. cheniourensis.*

So far *P. cheniourensis* has been reported only from the Middle to Late Aptian, and *P. buxtorfi* from the Late Albian. Though the morphological features of the two taxa point to a close relationship neither form has so far been reported from the Early and Middle Albian which would provide the connecting link between the two taxa. A closer comparison of the Trinidad specimens regarded as very Late Aptian to earliest Albian in age with the respective holotypes could reveal features that might point to an intermediate morphological position. One such feature may be found in the last chambers which in the Trinidad specimens may not be as globular as in typical *P. cheniourensis* but already laterally somewhat compressed indicating a trend that eventually may lead to an acute periphery and finally to the development of a keel as is typical for *P. buxtorfi.*

Schackoina reicheli BOLLI 1957

Pl. 6, Fig. 29

1957 *Schackoina reicheli* BOLLI n. sp. – BOLLI, Eclogae geol. Helv. *50*/2, 275; Pl. 1, Fig. 8–10.
1966 *Schackoina reicheli* BOLLI – MOULLADE, Doc. Lab. Géol. Fac. Sci. Lyon *15*, 116.
1979 *Leupoldina reicheli* (BOLLI) – KAPTARENKO-CHERNOUSOVA, PLOTNIKOVA & LIPNIK, Inst. Geol. NAUK (Kiev) 74, Pl. 21, Fig. 3.

Occurrence. – The species was originally described from the *Leupoldina protuberans* Zone of Trinidad's Cuche Formation (BOLLI 1957a). In BOLLI (1959) its range was shown to extend also into the next younger *Planomalina maridalensis* Zone of the Maridale Formation. Its presence in the *Hedbergella rohri* Zone indicates that the species ranges throughout the Maridale Formation. Recorded also in the Ukraine and Crimea from the Upper Aptian.

Remarks. – Typical for the species are the tube like strongly extended final chambers of the last whorl. In the single, poorly preserved specimen found in the examined *Hedbergella rohri* Zone material this characteristic feature is partially preserved only in the last chamber; in the four earlier ones only the basal portions remain.

Stratigraphic conclusions

The *Hedbergella rohri* Zone fauna of the Maridale Formation described in this paper is regarded as being of Late Aptian to earliest Albian age based on planktic and benthic foraminiferal evidence. On planktic foraminifera the following is relevant to such a determination:

According to CARON (1985) *Hedbergella trocoidea, Ticinella bejaouensis* and *T. roberti,* respectively, overlap in the *Ticinella bejaouensis* Zone since *H. trocoidea* becomes extinct at the top of the zone whereas *T. bejaouensis* and *T. roberti* appear at, or close to its base.

With regard to the shape arrangement of chambers and their number in the last whorl, these three taxa are morphologically very close (see CARON 1985: Fig. 25/17–18; Fig. 36/1–3, 13–15), the only major difference being that the *Ticinella* species contain secondary umbilical sutural apertures which are absent in *Hedbergella.* As the presence and absence of such secondary apertures can only be determined in well preserved specimens, it may at times be difficult to separate these three species with certainty. The morphology of the zonal marker *Hedbergella rohri* leaves little doubt that it is also very close to this group of species. Its occurrence in Trinidad together with *Planomalina cheniourensis,* which according to CARON becomes extinct within the *Ticinella bejaouensis* Zone, is a good indication for a Late Aptian–earliest Albian age of the *Hedbergella rohri* Zone fauna.

It is for these reasons that the *Hedbergella rohri* Zone is here regarded as an approximate time equivalent of the *Ticinella bejaouensis* Zone which according to CARON bridges the Aptian–Albian boundary.

Of the benthic foraminifera occurring in the investigated fauna, it is particularly the following agglutinated species whose wide distribution and known ranges support a Late Aptian to earliest Albian age:

Dorothia filiformis: Upper Aptian to Upper Cretaceous
Dorothia gradata: higher Lower Albian to Upper Cretaceous
Gaudryina compacta: Upper Aptian to Lower Albian
Gaudryina dividens: Upper Aptian to Lower Albian
Gaudryina klamathensis: Upper Aptian to Lower Albian
Gaudryina reicheli: Upper Aptian to Lower Albian
Marssonella oxycona: Upper Aptian to Upper Cretaceous
Textularia bettenstaedti: predominantly Upper Aptian to Lower Albian
Verneuilinoides subfiliformis: Upper Hauterivian to Lower Albian

Compared with the agglutinated taxa, only a small number of calcareous benthic species have comparable limited ranges that provide further indication for the assumed Late Aptian to earliest Albian age. These are:

Lenticulina (L.) gaultina: Aptian and Albian
Lenticulina (L.) vocontiana: predominantly Upper Aptian
Ramulina berthelini: Upper Aptian to Lower Albian
Ramulina grandis: Aptian to Cenomanian
Conorotalites aptiensis: Upper Barremian to Lower Albian
Gavelinella intermedia: Lower Aptian to Upper Cretaceous

Further evidence of a Late Aptian to earliest Albian age is provided by the absence of certain stratigraphically significant benthic species listed on pages 976–978 that are known to be restricted to an age either older or younger. They include *Marssonella praeoxycona, Lenticulina (L.) nodosa* and *Lenticulina (S.) spinosa* known only to occur below the *Hedbergella rohri* Zone, or *Spiroplectinata annectans* and the genera *Pleurostomella* and *Pseudosigmoilina* of which the earliest occurrences are from the Middle Albian.

Based on the above evidence, the previously held view (BARTENSTEIN & BOLLI 1977, p. 561) that the *Hedbergella rohri* Zone occurred in the range Lower to Upper Albian has to be revised.

Index to genera and species, Part 1–5

(Part 1: 1957, Part 2: 1966, Part 3: 1973, Part 4: 1977, Part 5: 1986)

Legend

1 = Barremian Toco Formation, *Lenticulina barri* Zone
Cuche Formation, *Lenticulina ouachensis ouachensis* Zone
2 = Late Aptian Maridale Formation, Type locality, *Planomalina maridalensis* Zone
3 = Late Aptian Maridale Formation, Co-Type locality, *Planomalina maridalensis* Zone
4 = Early Aptian Cuche Formation, *Leupoldina protuberans* Zone
5 = Late Aptian to earliest Albian Maridale Formation, *Hedbergella rohri* Zone.
1:145 = number of paper and page. – New taxa are indicated with name and first citation in bold face.

Total number: 78 genera, 185 species and subspecies, 13 new species or new subspecies, and 52 forms with open nomenclature.

Acknowledgments

The authors wish to express their sincere thanks to F. Allemann and to F. Zweili (both University of Bern) for the preparation of the SEM photographs of the fauna reproduced in this paper. They are grateful to J. P. Beckmann (ETH Zürich) and to J. B. Saunders (Museum of Natural History, Basel) for discussing and reviewing the manuscript.

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Manuscript received and accepted 15 July 1986

Plates 1–6

The illustrated specimens numbered C 36181 to C 36451 are deposited at the Museum of Natural History, Basel.

D = Diameter in mm, L = Length in mm

All Figures ×40 except otherwise mentioned

Plate 1

All Figures ×40.

Fig. 1–3 *Ammodiscus tenuissimus* (Guembel 1862)
D: 0.5–0.52–0.3 mm. – C 36181–36183.

Fig. 4 *Glomospira charoides* (Jones & Parker 1860)
L: 0.33 mm. – C 36184.

Fig. 5–6 *Glomospira gordialis* (Jones & Parker 1860)
D: 0.33–0.42 mm. – C 36185–36186.

Fig. 7–8 *Glomospirella gaultina* (Berthelin 1880)
D: 0.42–0.45 mm. – C 36187–36188.

Fig. 9–10 *Hippocrepina depressa* Vasicek 1947
L: 0.7–0.52 mm. – C 36189–36190.

Fig. 11–13 *Hormosina ovulum* (Grzybowski 1866)
L: 0.55–0.67–0.75 mm. – C 36191–36193.

Fig. 14–17 *Hyperammina gaultina* Dam 1950
L: 0.73–0.62–1.03–0.88 mm. – C 36194–36197.
Fig. 14–15: Embryonic initial chamber.

Fig. 18–19 *Kalamopsis grzybowskii* (Dylazanka 1923)
L: 0.87–0.9 mm. – C 36198–36199.

Fig. 20–23 *Psammosphaera* sp.?
L: 0.52–0.45–0.37–0.65 mm. – C 36200–36203.
Fig. 21: Edge view. – Fig. 23: Two chambers loosely attached.

Fig. 24 *Reophax guttifer* H. B. Brady 1884
L: 0.78 mm. – C 36204.

Fig. 25 *Reophax minutus* Tappan 1940
L: 0.73 mm. – C 36205.

Fig. 26–27 *Reophax pilulifer* H. B. Brady 1884
L: 0.95–0.55 mm. – C 36206–36207. – Two different stages of growth.

Fig. 28–30 *Ammobaculites euides* Loeblich & Tappan 1949
L: 0.73–0.75–0.43 mm. – C 36208–36210.

Fig. 31–32 *Ammobaculites reophacoides* Bartenstein 1952
L: 0.65 mm both. – C 36211–36212.

Fig. 33–34 *Ammobaculites subcretaceus* Cushman & Alexander 1930
L: 0.72–0.55 mm. – C 36213–36214.

Fig. 35–36 *Bigenerina clavellata* Loeblich & Tappan 1946
L: 0.65–0.67 mm. – C 36215–36216.

Fig. 37 *Dorothia filiformis* (Berthelin 1880)
L: 0.48 mm, fragment. – C 36217.

Fig. 38–39 *Dorothia gradata* (Berthelin 1880)
Fig. 38: L: 0.5 mm, lateral view. – C 36218.
Fig. 39: D: 0.53 mm, apertural view, details of sutures and aperture not visible for coarseness of wall. – C 36219.

Fig. 40–41 *Gaudryina compacta* Grabert 1959
L: 0.62–0.48 mm. – C 36220–36221.

Fig. 42–43 *Gaudryina dividens* Grabert 1959
L: = 0.33–0.34 mm. – C 36222–36223.

Fig. 44–45 *Gaudryina klamathensis* (Dailey 1970)
L: 1.0–1.02 mm. – C 36224–36225.

Fig. 46–47 *Gaudryina reicheli* Bartenstein, Bettenstaedt & Bolli 1966
L: 1.05–0.67 mm. – C 36226–36227.

Fig. 48–52 *Haplophragmoides concavus* (Chapman 1893)
D: 0.6–0.35–0.33–0.37 mm. – C 36228–36232.
Various stages of deformation. – Fig. 48: Edge view. – Fig. 49–52: Lateral views.

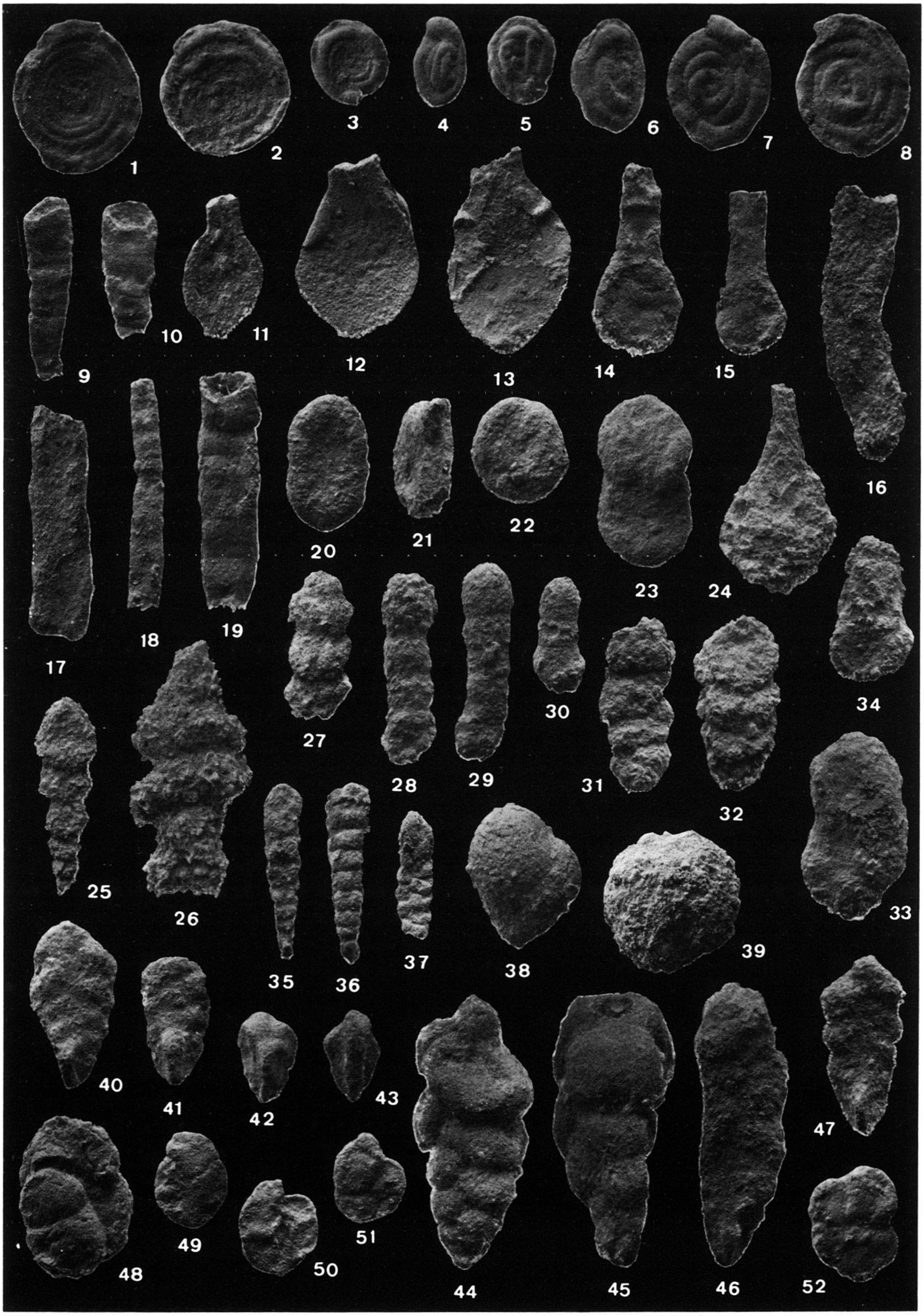
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Plate 2

All Figures × 40.

Fig. 1–2	*Gaudryinella sherlocki* BETTENSTAEDT 1952 L: 0.78–0.83 mm. – C 36233–36234.
Fig. 3–5	*Haplophragmoides nonioninoides* (REUSS 1863) D: 0.6–0.58–0.6 mm. – C 36235–36237. Various stages of deformation. – Fig. 5: Edge view.
Fig. 6–7	*Marssonella oxycona* (REUSS 1860) L: 0.3–0.5; D: 0.42–0.65 mm. – C 36238–36239.
Fig. 8–10	*Marssonella subtrochus* BARTENSTEIN 1962 L: 0.52–0.33–0.35; D: 0.88–0.6–0.63 mm. – C 36240–36242. Fig. 9: Edge view.
Fig. 11–13	*Plectorecurvoides alternans* NOTH 1952 D: 0.5–0.65–0.99 mm. – C 36243–36245. Various stages of preservation. – Fig. 11: Apertural view.
Fig. 14–15	*Textularia bettenstaedti* BARTENSTEIN & OERTLI 1977 L: 0.57–0.6 mm. – C 36246–36247.
Fig. 16–18	*Tritaxia plummerae* CUSHMAN 1936 L: 0.63–0.56–0.38 mm. – C 36248–36250.
Fig. 19	*Trochammina depressa* LOZO 1944 L: 0.77 mm, spiral view. – C 36251.
Fig. 20	*Trochammina* sp. D: 0.45 mm. – C 36252.
Fig. 21–22	*Valvulina fusca* (WILLIAMSON 1858) D: 0.8–1.0 mm, spiral views. – C 36253–36254.
Fig. 23–25	*Verneuilinoides subfiliformis* BARTENSTEIN 1952 L: 0.55–0.4–0.5 mm. – C 36255–36257.
Fig. 26–27	*Agathammina* sp.? L: 0.53–0.45 mm. – C 36258–36259.
Fig. 28	*Quinqueloculina sabella* LOEBLICH & TAPPAN 1946 L: 0.46 mm. – C 36260.
Fig. 29–30	*Quinqueloculina* sp.? L: 0.48–0.35 mm. – C 36261–36262.
Fig. 31	*Dentalina aequivoca* (REUSS 1863) L: 0.87 mm, fragment. – C 36263.
Fig. 32–34	***Dentalina bonaccordensis* n. sp.** Fig. 32: Holotype; L: 1.35 mm. – C 36264. Fig. 33:–34: Paratypes; L: 0.95–0.75 mm. – C 36265–36266.
Fig. 35	*Dentalina catenula* REUSS 1860 L: 1.95 mm. – C 36267.
Fig. 36–37	*Dentalina communis* ORBIGNY 1826 L: 1.02 mm both. – C 36268–36269.
Fig. 38–39	*Dentalina cylindroides* REUSS 1860 L: 1.1–1.45 mm. – C 36270–36271.
Fig. 40–41	*Dentalina distincta* REUSS 1860 L: 0.88–1.12 mm. – C 36272–36273.
Fig. 42–43	*Dentalina expansa* REUSS 1860 L: 1.1.–0.82 mm, fragments. – C 36274–36275.
Fig. 44–46	*Dentalina nana* REUSS 1863 L: 0.79–0.56–0.4 mm. – C 36276–36278. Fig. 45–46: Juvenile specimens.

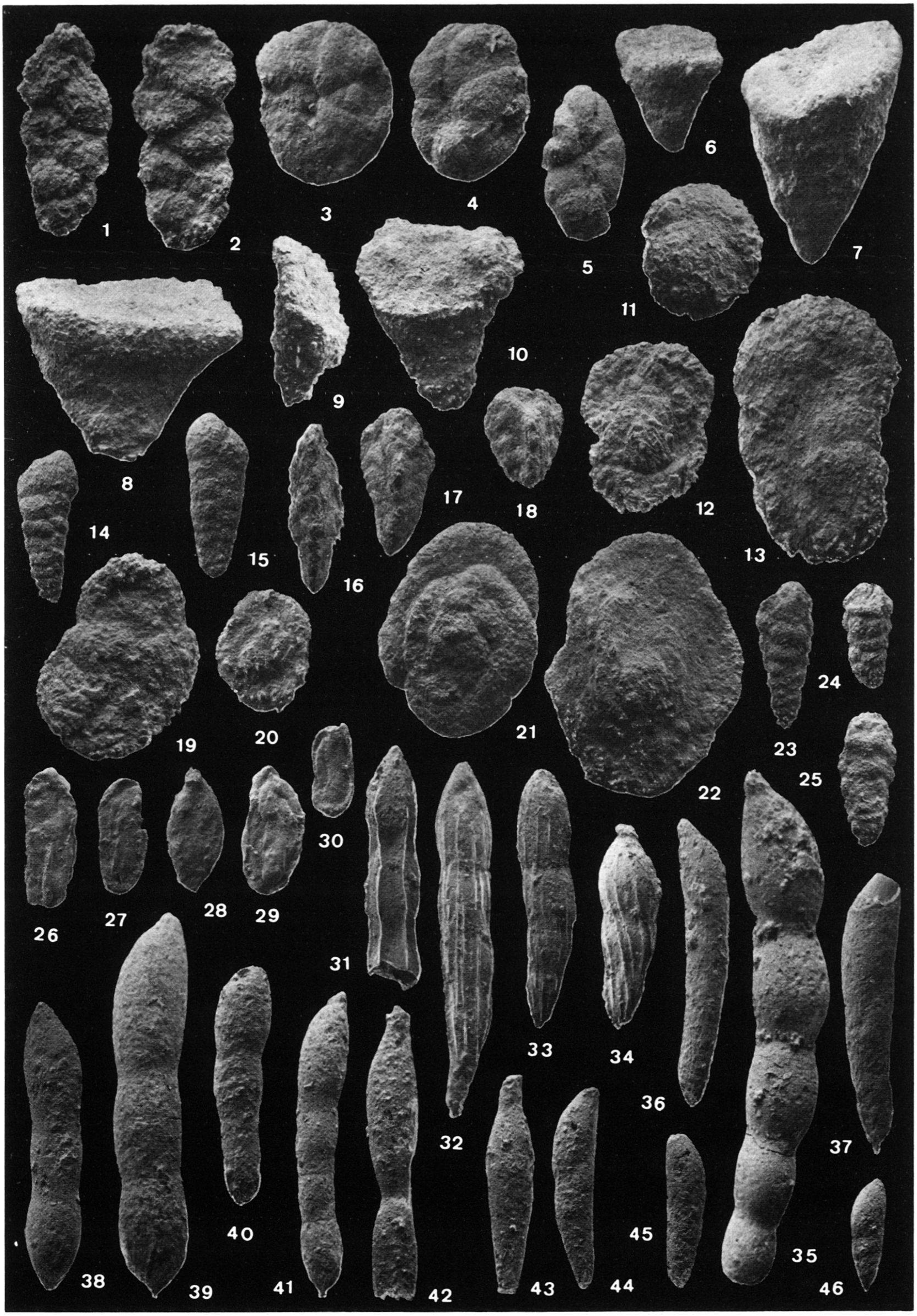
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Plate 3

All Figures ×40; except 18b, 19b, 45b: ×60

Fig. 1–3	*Dentalina filiformis* REUSS 1845 L: 1.06–0.88–0.5 mm. – C 36279–36281. Fig. 2–3: Fragments.
Fig. 4–6	*Dentalina gracilis* ORBIGNY 1839 L: 1.8–0.75–0.75 mm. – C 36282–36284.
Fig. 7–8	*Dentalina linearis* (ROEMER 1841) L: 0.51–1.12 mm. – C 36285–36286. Fig. 7: Juvenile specimen. – Fig. 8: Fragment.
Fig. 9–10	*Dentalina* aff. *oligostegia* (REUSS 1845) L: 1.05–0.74 mm. – C 36287–36288.
Fig. 11–12	*Dentalina soluta* REUSS 1851 L: 1.65–1.27 mm – C 36289–36290.
Fig. 13	*Dentalina subguttifera* BARTENSTEIN 1952 L: 1.26 mm. – C 36291.
Fig. 14–15	*Dentalina* cf. *terquemi* ORBIGNY 1850 L: 0.65–0.74 mm, fragments. – C 36292–36293.
Fig. 16–17	*Bullopora laevis* (SOLLAS 1877) L: 0.43–0.6 mm, fragments. – C 36294–36295.
Fig. 18–19	*Falsoguttulina vandenboldi* (BARTENSTEIN, BETTENSTAEDT & BOLLI 1957) L: 0.26–0.23 mm. – C 36296–36297.
Fig. 20–22	*Globulina prisca* REUSS 1863 L: 0.58–0.55–0.37 mm, weathered specimens. – C 36298–36300.
Fig. 23	*Guttulina* aff. *symbloca* LOEBLICH & TAPPAN 1949 L: 0.72 mm, weathered fragment. – C 36301.
Fig. 24–25	*Pyrulina cylindroides* (ROEMER 1838) L: 0.57–0.53 mm, corroded specimens. – C 36302–36303.
Fig. 26–28	*Pyrulina exserta* (BERTHELIN 1880) L: 0.43–0.55–0.62 mm, partly corroded specimens. – C 36304–36306.
Fig. 29–33	*Ramulina aculeata* WRIGHT 1863 L: 1.02–0.67–0.63–0.52–0.37 mm. – C 36307–36311. Fig. 29–32: Fusiform tests, surface coarsely hispid (29, 31) or more finely hispid (30, 32); see also Trinidad *2*, Pl. 4, Fig. 325–329, 331–335. – Fig. 33: Fistulose and branching test, surface finely hispid; see also Trinidad *2*, Pl. 4, Fig. 317, 322–323.
Fig. 34–37	*Ramulina globulifera* H. B. BRADY 1849 L: 0.68–0.43–0.58–0.53 mm. – C 36312–36315. – Surface very finely hispid (Fig. 34–36) to smooth (Fig. 37).
Fig. 38	*Ramulina berthelini* BARTENSTEIN & BOLLI 1973 L: 1.6 mm. – C 36316.
Fig. 39–40	*Ramulina grandis* (FUCHS 1967) D: 0.5–0.55 mm. – C 36317–36318.
Fig. 41	*Flabellinella didyma* (BERTHELIN 1880) L: 0.72 mm. – C 36319. – Juvenile test with beginning of the inverted chevron-shaped chambers ("*Frondicularia*" stage).
Fig. 42–43	*Frondicularia gaultina* REUSS 1860 L: 0.65–0.64 mm, fragments. – C 36320–36321. Fig. 42: True *Frondicularia* type. – Fig. 43: Form transitional to *Flabellinella didyma*.
Fig. 44–45	*Lagena apiculata* (REUSS 1851) L: 0.6–0.33 mm. – C 36322–36323. Fig. 45: corroded juvenile specimen.
Fig. 46–48	*Lagena globosa* (MONTAGU 1803) D: 0.45–0.5–0.48 mm. – C 36324–36326. Fig. 46: Transitional form to *Lagena apiculata*. Fig. 47–48: Test distinctly corroded.

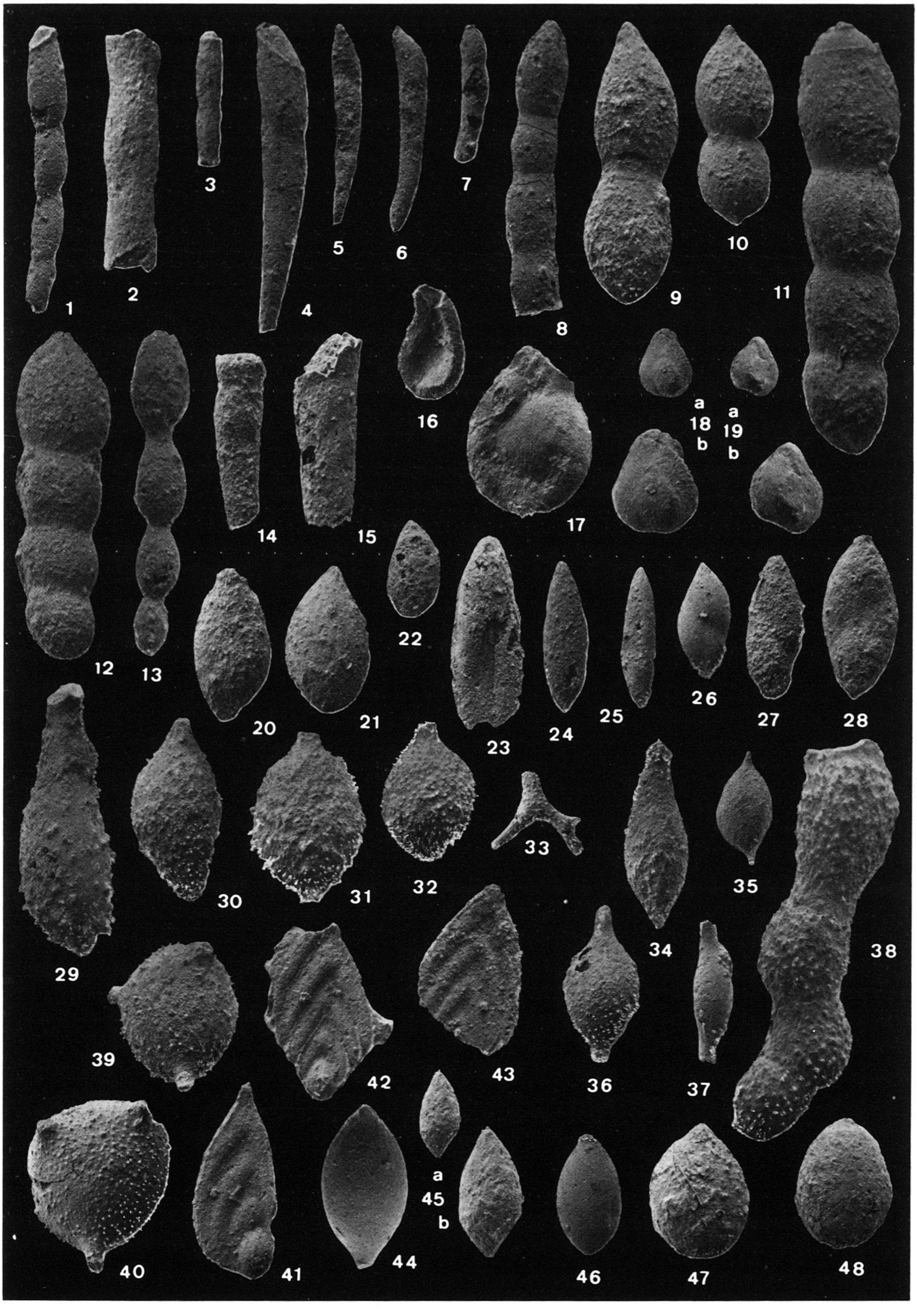
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Plate 4

All Figures ×40; except Fig. 1b, 2b: ×60

Fig. 1–3 *Lagena laevis* (MONTAGU 1803)
L: 0.27–0.32–0.43 mm. – C 36327–36329.

Fig. 4–6 *Lagena* aff. *oxystoma* REUSS 1860
L: 0.4–0.38–0.65 mm. – C 36330–36332.

Fig. 7–8 *Lenticulina* (*L.*) *acuta* (REUSS 1860)
L: 0.65–0.67 mm. – C 36333–36334.

Fig. 9–10 *Lenticulina* (*A.*) *calliopsis* (REUSS 1863)
L: 1.62–1.1 mm. – C 36335–36336.
Fig. 9: Microspheric stage, Fig. 10: Megalospheric stage.

Fig. 11–12 *Lenticulina* (*M.*) *cephalotes* (REUSS 1863)
L: 0.7–0.45 mm. – C 36337–36338.

Fig. 13 *Lenticulina* (*P.*) *complanata* (REUSS 1845)
L: 0.98 mm. – C 36339.

Fig. 14–15 *Lenticulina* (*L.*) *gaultina* (BERTHELIN 1880)
D: 1.23–1.2 mm. – C 36340–36341.

Fig. 16 *Lenticulina* (*A.*) *grata* (REUSS 1863)
L: 0.99 mm. – C 36342.

Fig. 17–18 *Lenticulina* (*M.*) *inaequalis* (REUSS 1860)
L: 0.63–0.55 mm. – C 36343–36344.

Fig. 19–21 *Lenticulina* (*V.*) *incurvata* (REUSS 1863)
L: 0.95–0.87–0.95 mm. – C 36345–36347.

Fig. 22–23 *Lenticulina* (*M.*) *lituola* (REUSS 1846)
L: 1.07–1.05 mm. – C 36348–36349.
Fig. 22: Distinctly corroded.

Fig. 24 *Lenticulina* (*L.*) *meridiana* BARTENSTEIN, BETTENSTAEDT & KOVATCHEVA 1971
L: 0.85 mm. – C 36350.

Fig. 25–26 *Lenticulina* (*L.*) *muensteri* (ROEMER 1839)
D: 1.13–1.02 mm, walls weathered. – C 36351–36352.

Fig. 27–29 *Lenticulina* (*A.*) *perobliqua* (REUSS 1863)
L: 0.62–0.45–0.42 mm. – C 36353–36355.

Fig. 30–31 *Lenticulina* (*M.*) *robusta* (REUSS 1863)
L: 0.53–0.62 mm. – C 36356–36357.

Fig. 32–34 *Lenticulina* (*L.*) *saxocretacea* BARTENSTEIN 1954
D: 0.98–1.05–0.88 mm. – C 36358–36360.

Fig. 35–36 *Lenticulina* (*A.*) *schloenbachi* (REUSS 1863)
L: 0.42–0.65 mm. – C 36361–36362.

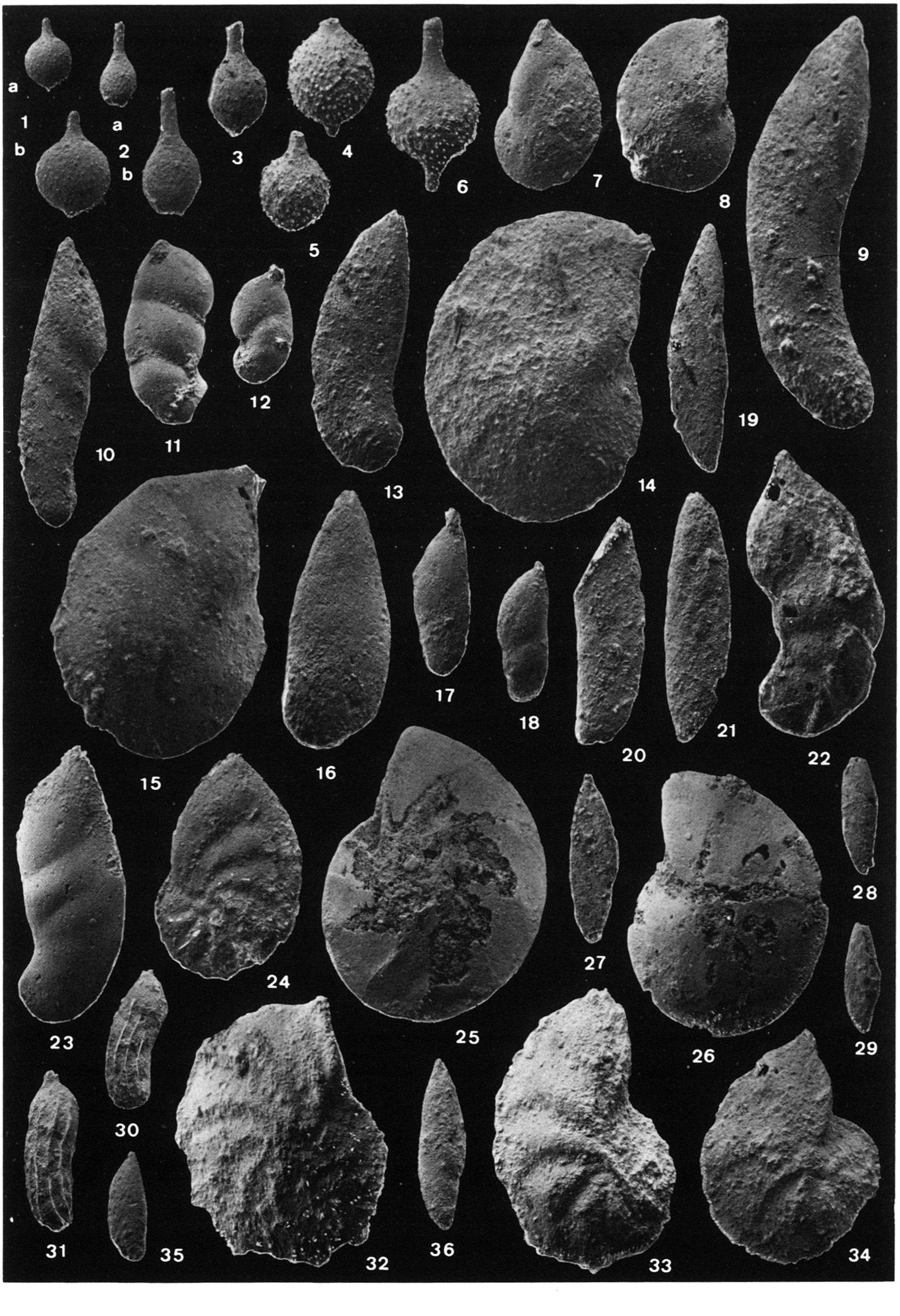
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Plate 5

All Figures ×40; except Fig. 5, 6: ×30, Fig. 27b, 40b: ×60

Fig. 1	*Lenticulina (L.) roemeri* (REUSS 1863) D: 0.64 mm. – C 36363.
Fig. 2–4	*Lenticulina (A.) scitula* (BERTHELIN 1880) L: 0.6–0.5–0.74 mm. – C 36364–36366.
Fig. 5–6	*Lenticulina (L.) turgidula* (REUSS 1863) L: 1.63–2.05 mm. – C 36367–36368.
Fig. 7–9	*Lenticulina (L.) vocontiana* MOULLADE 1966 D: 0.48–0.46–0.65 mm. – C 36369–36371. – The tests appear to be relatively undersized and not typical in their ornamentation.
Fig. 10–12	***Lenticulina caribica* n. sp.** Fig. 10: Holotype. – L: 1.3 mm. – C 36372. Fig. 11–12: Paratypes. – L: 1.05–0.6 mm. – C 36373–36374.
Fig. 13–14	***Lenticulina (L.) antillica* n. sp.** Fig. 13: Paratype. – L: 1.12 mm. – C 36375. Fig. 14: Holotype. – L: 1.17 mm, – C 36376.
Fig. 15–16	*Lingulina loryi* (BERTHELIN 1880) L: 0.6–0.52 mm. – C 36377–36378.
Fig. 17–18	*Marginulina bullata* REUSS 1845 L: 0.46–0.43 mm. – C 36379–36380.
Fig. 19–20	*Marginulina pyramidalis* (KOCH 1851) L: 0.55–0.57 mm, fragments. – C 36381–36382. Fig. 19: Apertural portion. – Fig. 20: Primordial position.
Fig. 21–22	*Nodosaria jonesi* REUSS 1863 L: 0.65–0.71 mm. – C 36383–36384.
Fig. 23–24	*Nodosaria linearis* ROEMER 1841 L: 0.69–0.52 mm. – C 36385–36386.
Fig. 25–26	*Nodosaria obscura* REUSS 1845 L: 0.85–0.63 mm. – C 36387–36388. Fig. 25: Septal face with 5–6 ribs. Fig. 26: Septal face with 3–4 ribs.
Fig. 27–29	*Nodosaria orthopleura* REUSS 1863 Fig. 27: transverse section. D: 0.27 mm. – C 36389. Fig. 28–29: L: 1.25–0.9 mm. – C 36390–36391.
Fig. 30–31	*Nodosaria paupercula* REUSS 1845 L: 0.75–0.79 mm. – C 36392–36393. Fig. 30: Multicostate specimen. Fig. 31: Specimen with few costae.
Fig. 32–34	*Nodosaria sceptrum* REUSS 1863 L: 0.65–0.7–0.7 mm. – Fig. 32: Final chamber only. – C 36394–36396.
Fig. 35	*Orthokarstenia shastaensis* DAILEY 1970 L: 0.48 mm. – C 36397. – A slender microspheric test, beginning with a series of 8 biserially arranged chambers and ending with a uniserial series of three chambers. The original tests by DAILEY 1970 are longer (0.58 up to 1.05 mm) and broader (0.3 mm).
Fig. 36–37	*Pseudonodosaria humilis* (ROEMER 1841) L: 0.7–0.58 mm, tests slightly corroded. – C 36398–36399.
Fig. 38	*Tristix acutangula* (REUSS 1863) L: 0.51 mm, broken and corroded specimen. – C 36400.
Fig. 39–41	*Tristix globulifera* (REUSS 1860) Fig. 39, 41: L: 0.45–0.51 mm. – C 36401, 36403. Fig. 40a, 40b: apertural view, apertural hole eccentric indicating a questionable *Lenticulina* aperture. – C 36402.

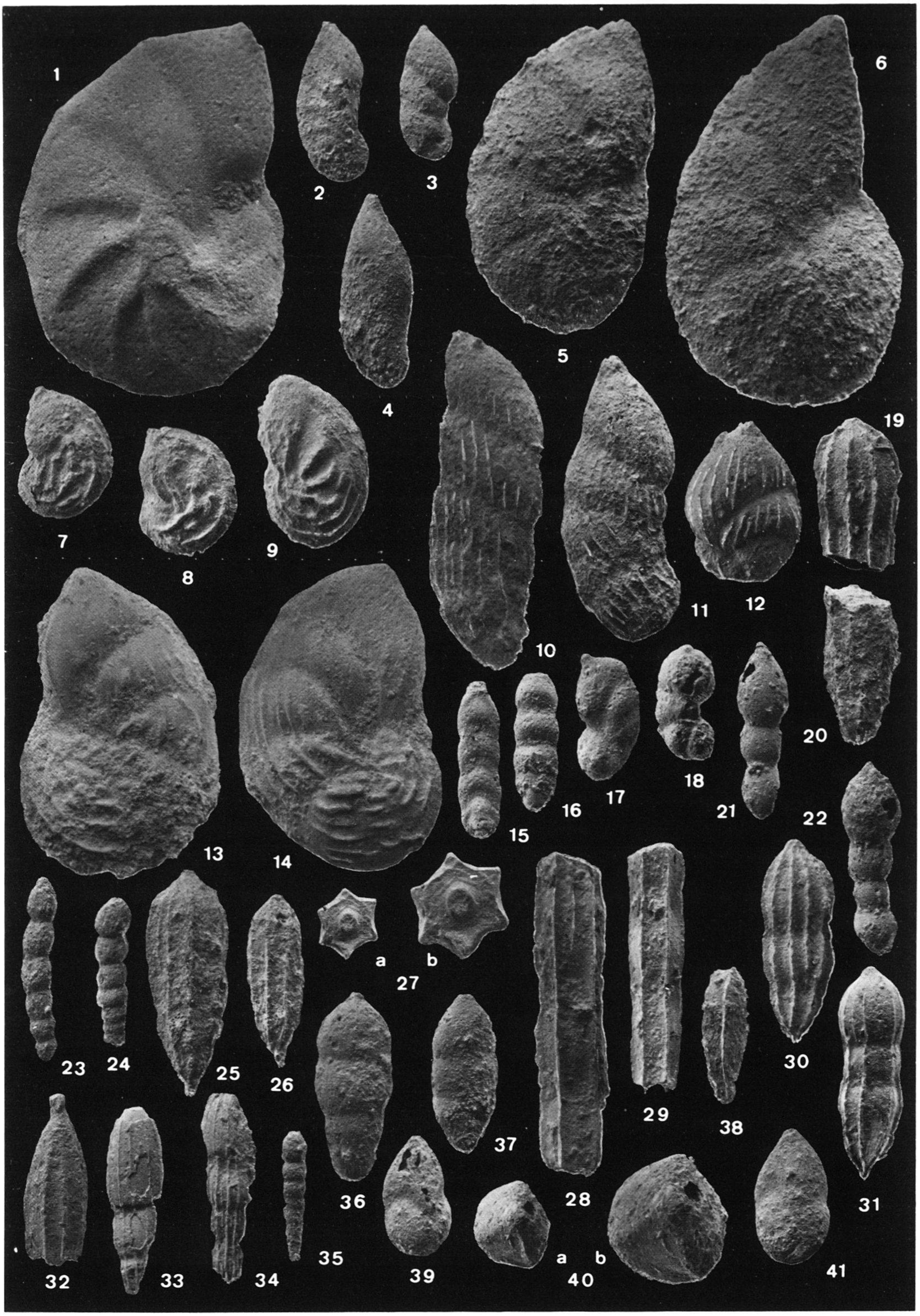
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Plate 6

All Figures ×40; except Fig. 4: ×30, Fig. 14b, 15b, 27b, 29: ×60

Fig. 1–3 *Pseudonodosaria mutabilis* (REUSS 1863)
L: 1.22–0.82–0.71 mm. – C 36404–36406.
Fig. 1: Oversized test, possibly local gigantism. – Fig. 3: Test corroded with damaged apertural chamber.

Fig. 4–6 *Vaginulina arguta* REUSS 1860
L: 1.6–0.93–1.17 mm. – C 36407–36409.
Fig. 4: Microspheric specimen with spiral initial part. – Fig. 5: Microspheric specimen. – Fig. 6: Megalospheric specimen with damaged apertural chamber.

Fig. 7–8 *Vaginulina recta* REUSS 1863
L: 1.0–0.7 mm, broken specimens. – C 36410–36411.

Fig. 9 *Vaginulina geisendoerferi* FRANKE 1928
L: 0.6 mm, broken specimen. – C 36412.

Fig. 10 *Vaginulina striolata* REUSS 1863
L: 0.78 mm, damaged specimen. – C 36413.

Fig. 11–13 *Conorotalites aptiensis* (BETTENSTAEDT 1952)
D: 0.43–0.55–0.43 mm. – C 36414–36416.
Fig. 11: Apertural view. – Fig. 12: Spiral view. – Fig. 13: Umbilical view.

Fig. 14–22 *Gavelinella intermedia* (BERTHELIN 1880)
D: 0.3–0.3–0.53–0.56–0.5–0.55–0.43–0.48–0.48 mm. – C 36417–36425.
Fig. 14–15: Small specimens, Fig. 16–22: Normal sized specimens. – Fig. 20–22: Specimens with progressive stages similar to those on Pl. 50, Fig. 4–5 by MICHAEL 1966 from the German Upper Aptian. – Fig. 14–19 similar to those on Pl. 50, Fig. 7 and 10 by MICHAEL 1966 from the German Lower Albian. – Fig. 18, 19, 22: Apertural face; Fig. 14, 16, 20: umbilical view: Fig. 15, 17, 21: Spiral view.

Fig. 23–26 *Valvulineria loetterlei* (TAPPAN 1940)
D: 0.33–0.38–0.38–0.45 mm. – C 36426–36429.
Fig. 23, 25: Spiral view.– Fig. 24: Umbilical view. – Fig. 26: Apertural view.

Fig. 27–28 *Spirillina minima* SCHACKO 1892
D: 0.23–0.48 mm. – C 36430–36431.
Figures 29–48: PLANCTIC FORAMINIFERA

Fig. 29 *Schackoina reicheli* BOLLI 1957
L: 0.27 mm. – C 36432.

Fig. 30 *Globigerinelloides* cf. *blowi* (BOLLI 1959)
D: 0.42 mm. – C 36433.

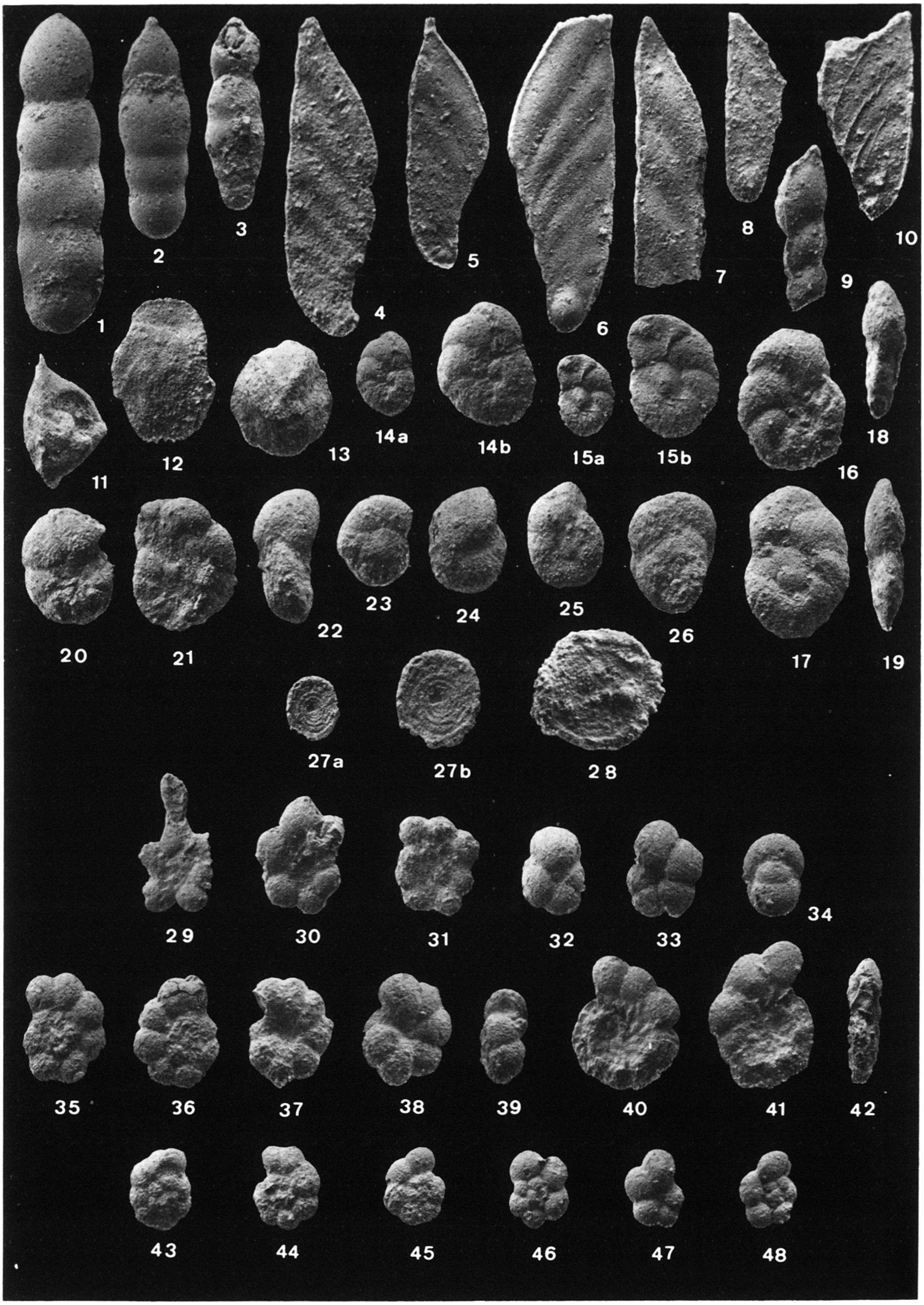
Fig. 31 *Globigerinelloides ferreolensis* (MOULLADE 1961)
D: 0.38 mm. – C 36434.

Fig. 32–34 *Globigerinelloides? gyroidinaeformis* MOULLADE 1966
D: 0.33–0.36–0.31 mm. – C 36435–36437.
Fig. 32–33: Lateral views. – Fig. 34: Apertural view.

Fig. 35–39, 43–45 *Hedbergella rohri* (BOLLI 1959)
D: 0.4–0.38–0.4–0.43–0.35 (Fig. 35–39). – C 36438–36442.
D: 0.35–0.31–0.23 mm (Fig. 43–45). – C 36443–36445.
Fig. 35:–36: Spiral views. – Fig. 37–38: Umbilical views. – Fig. 39: Apertural view. – Fig. 43–45: Spiral views of small specimens.

Fig. 40–42 *Planomalina cheniourensis* (SIGAL 1952)
D: 0.45–0.44–0.43 mm. – C 36446–36448.
Fig. 40–41: Lateral views. – Fig. 42: Apertural view.

Fig. 46–48 *Hedbergella delrioensis* (CARSEY 1926)
D: 0.26–0.25–0.23 mm. – C 36449–36451.
Fig. 46–48: Spiral views. – Fig. 47: Umbilical view.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